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American Veterinary Medical Association

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(Original Official Organ U. S. Vet. Med. Ass'n.)

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H. Preston Hoskins, Secretary-Editor, 716 Book Building, Detroit, Mich.

REUBEN HILTY, President, Toledo, Ohio. M. JACOB, Treasurer, Knoxville, Tenn.

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GROWING PAINS

Five years have passed since the American Veterinary Medical Association took the longest stride forward in the history of the organization—the establishment of its own official headquarters and the centralization of its major activities there. Events of the past five years leave little, if any, doubt of the wisdom of this move. Even now, we occasionally hear the question asked, "Why was it not done sooner?"

It would appear perfectly in order at this time to direct attention to the fact that the offices of Secretary and Editor have been consolidated, with the attendant expense of moving the equipment of these two offices; headquarters rented in a modern office building; necessary office equipment in the form of desks, typewriters, filing cases, bookcases and other office accessories purchased and installed; a full-time staff of three persons engaged to devote their entire time to the work of the Association—all this without drawing upon the Association's financial reserves, built up, wisely, during the fat years of a decade ago.

With the establishment of official headquarters and the employment of a full-time staff, the activities of the A. V. M. A. have extended and the work increased very materially. The Association is now in a position to render a greater service to its members than at any time before. The problems of the pro-

fession are increasing, in keeping with the progress that is being made in all lines generally, attended by greater complications as the intricacies and ramifications of our economic and social structures multiply.

Our members are demanding that the proper officers or committees give their attention to those problems that are most pressing. And rightly so. Most of these problems are national in scope and character, and if the American Veterinary Medical Association does not tackle these problems, who or what body will do so?

Many of the major problems have been the subjects of discussion at meetings of the Executive Board during recent years. Progress has been made in the solution of some of them. Others are being ably handled by standing or special committees, either of the Association or of the Board. The annual reports of our officers and committees record the progress that is being made. As a concrete example of what is being done, we would refer to the report of our Committee on Legislation, made at Philadelphia, in the matters of narcotic record-keeping and alcohol allowances for veterinarians.

Recognizing the growing needs of the present situation the Executive Board has approved a recommendation to enlarge our headquarters. The year 1928 sees our office space increased almost 100 per cent. During the year the working staff will be increased. Additional equipment will be installed to facilitate the handling of the Association's business and to enhance the usefulness of the organization, with the idea of rendering more and better service to our members.

In the words of Dr. Raymond A. Pearson, "Things that are growing are most apt to attract attention. So many things in the United States are growing that the veterinary profession is not getting the attention it deserves." Even though the profession is not growing in numbers, the A. V. M. A. is growing, both in numbers and importance, so much so that it has become necessary to do something to alleviate our growing pains. *The number of members who carried 1927 membership cards exceeded by over 300 the number of paid-up members for 1926.*

Farmers have the same right to class legislation as anybody else, which is none at all.

—E. S. BAYARD in *The Stockman and Farmer.*

CONVENTION DATES SELECTED

The Executive Board has fixed the dates of the Minneapolis meeting for August 7-8-9-10, 1928, after very careful consideration of all factors involved. Although the meeting is almost eight months away, as this is written, there are good reasons to believe that the Minneapolis convention will be the largest gathering of veterinarnais ever held in this country. The Local Committee on Arrangements is organized and at work, under the able leadership of Dr. Chas. E. Cotton as chairman and with Dr. C. P. Fitch as secretary. Subcommittees have been appointed to look after the many details of the meeting.

Secretary Fitch is authority for the statement that there will be no meeting of the Minnesota State Veterinary Medical Association next summer. Iowa and South Dakota do not hold summer meetings. Sentiment has already been expressed by veterinarians in Wisconsin, North Dakota and Montana that it would be better to call off the summer meetings in these states, rather than to try to compete with the A. V. M. A. meeting. The same reports come from the western provinces of Canada. As one veterinarian put it: "It is better to have one great big successful meeting than half a dozen small ones poorly attended."

It is to be hoped that the officers of the Missouri Valley Veterinary Association will see their way clear to postpone the meeting scheduled to be held in Kansas City in July. This would practically clear the way of all counter-attractions in this territory during the summer months. There is a limit to the number of meetings that a veterinarian can attend, particularly the man in private practice.

Let's all go to Minneapolis.

PRESIDENT HILTY KEPT BUSY

President Hilty has been kept on the move the past month, and January and February promise no let-up in his activities. The first meeting attended by President Hilty, following the Philadelphia convention, was the opening fall meeting of the Southeastern Michigan Veterinary Medical Association, in Detroit. On this occasion Dr. Hilty paid his first visit to the A. V. M. A. official headquarters. Since then he has visited the office on two other occasions. In addition, he has made use of the long distance telephone several times, when urgent business necessitated getting in touch with the Secretary-Editor. It is

indeed a new sensation to have our chief executive close enough for him to drop in occasionally or to be able to discuss important matters with us by phone.

Four meetings in Chicago were attended by Dr. Hilty, during the week of November 28. The first was the annual meeting of the Illinois State Veterinary Medical Association. Then came the United States Live Stock Sanitary Association, closely followed by the winter meeting of the Executive Board of the American Veterinary Medical Association. The fourth meeting was the annual convention of the National Association of Bureau of Animal Industry Veterinarians. This meeting, by the way, was attended also by Dr. Robert S. MacKellar, member-at-large of the Executive Board, and the Secretary-Editor. It is quite likely that this is the first meeting of its kind to be addressed by three officers of the A. V. M. A.

December 13-14 found President Hilty in Lincoln, attending the annual meeting of the Nebraska State Veterinary Medical Association. The following week found him in Detroit again, to attend a farewell dinner to Dr. E. P. Schaffter, just prior to the latter's departure for Los Angeles, to take charge of the B. A. I. station there.

NEARING THE GOAL

Contributions to the Schmidt Memorial Fund already in hand now are in excess of $800.00, due to the generosity of individual veterinarians and veterinary organizations in all parts of the United States. Dr. W. J. Embree, chairman of the Schmidt Memorial Fund Committee, has been stirring up the veterinary associations not yet heard from and it is hoped that those not already having done so will take appropriate action at the meetings held this month.

In addition to the lists of contributions published in the JOURNAL previously, the following amounts have been received and credited to the Fund:

Chicago Veterinary Society	$ 10.00
Eastern Iowa Veterinary Medical Association	15.00
Hudson Valley Veterinary Medical Association	10.00
Missouri Valley Veterinary Association	25.00
South Carolina Association of Veterinarians	15.00
Jensen-Salsbery Laboratories, Kansas City, Mo.	100.00
Dr. W. J. Butler, Helena, Montana	2.00
Dr. D. M. Campbell, Chicago, Ill.	10.00
Dr. P. C. Juhl, Staten Island, N. Y.	5.00

Again, we repeat, "Let's finish the job."

IN MEMORIAM

Dr. John A. Kiernan

A staunch and mighty bulwark fell,
And severed was a treasured bond—
A loss beyond mere words to tell—
John Kiernan, when you passed beyond.

Alas! To us is not revealed
The wisdom of the Mightier Mind;
But when for you the trumpet pealed,
You left a sorrowing host behind.

Your genial nature loved to give
Of all your talents without end.
A strong but kind executive,
You were a true and loyal friend.

Whene'er an address you would start
With forceful accents ringing clear,
You won your way to every heart,
For all knew that you were sincere.

You spread good will from state to state,
Kept all in concord with the Plan,
Glad always to conciliate,
And yet you feared not any man.

The great work under your command
On other shoulders now must fall;
Your precepts will forever stand,
A star of guidance for us all.

—Harold N. Guilfoyle.

APPLICATIONS FOR MEMBERSHIP

See October, 1927, Journal

First Listing

Bogan, James Joseph — 100 W. Bridge St., Catskill, N. Y.
D. V. M., Cornell University, 1923
Vouchers: H. B. Leonard and Bert J. Cady.

Caslick, William — 504 N. Aurora St., Ithaca, N. Y.
D. V. M., Cornell University, 1927
Vouchers: E. L. Brunett and C. E. Hayden.

CHURCH, HAROLD L. Battle Creek, Nebr.
D. V. M., Kansas State Agricultural College, 1925
Vouchers: Frank Breed and Floyd Perrin.

CLELAND, LAUREN WILSON 429 N. Bluff St., Janesville, Wis.
M. D. C., Chicago Veterinary College, 1911
Vouchers: V. S. Larson and James S. Healy.

COON, CHARLES J. Wamego, Kans.
D. V. M., Kansas State Agricltural College, 1924
Vouchers: Edwin J. Frick and C. A. Brandly.

DAY, WILLIAM EDWARD General Delivery, South St. Paul, Minn.
D. V. M., Iowa State College, 1900
Vouchers: G. E. Totten and W. F. Rode.

HUNT, M. P. 207 Leslie St., Lansing, Mich.
D. V. M., Grand Rapids Veterinary College, 1908
Vouchers: W. N. Armstrong and B. J. Killham.

LOUDON, ROY V. 511 W. 4th St., McCook, Nebr.
D. V. M., Ohio State University, 1924
Vouchers: C. H. Hays and A. H. Francis.

MADSON, ARCHIE R. Mishicot, Wis.
D. V. M., Chicago Veterinary College, 1912
Vouchers: V. S. Larson and James S. Healy.

ROGERS, FESTUS LOREN Cadiz, Ohio
D. V. M., Ohio State University, 1926
Vouchers: F. A. Zimmer and W. E. Clemons.

SIMON, HENRY ALBERT Co leridge, Nebr.
D. V. S., Chicago Veterinary College, 1910
Vouchers: Frank Breed and Floyd Perrin

VAN NESS, WALTER R. Lebanon, Ohio
V. S., Ontario Veterinary College, 1907
D. V. M., McKillip Veterinary College, 1908
Vouchers: D. M. Swinehart and A. J. DeFosset.

VARA, JOSEPH J. Bonifay, Fla.
D. V. M., Cornell University, 1914
Vouchers: A. L. Shealy and R. L. Brinkman.

VON ROSENBERG, HILTON O. Hallettsville, Texas.
D. V. M., Texas A. & M. College, 1920
Vouchers: N. F. Williams and T. O. Booth.

WENBORNE, HARRY GEORGE Allenton, Wis.
D. V. S., Ohio Veterinary College, 1894
Vouchers: V. S. Larson and James S. Healy.

Applications Pending

SECOND LISTING

Kirkwood, Glenn B., 4130 Carolin St., Long Island City, N. Y.
Lee, C. L., Iola, Wis.
Lee, Chester D., Iowa State College, Ames, Iowa.
Minshall, George W., Viroqua, Wis.
Moyle, Isaac William, Big Bend, Wis.
Patterson, Clement H., Tiskilwa, Ill.
Schilling, Samuel James, Univ. of Arkansas, Fayetteville, Ark.
Stringham, George Lauder, Wappingers Falls, N. Y.
Wright, Leon M., 506 Elm St., Watertown, Wis.

REINSTATED

Hall, Willis Franklin, Anadarko, Okla.
Smith, A. R., 300 Federal Bldg., Wheeling, W. Va.
Sugg, Redding S., Auburn, Ala.

The amount that shall accompany an application filed this month is $10.00, which covers membership fee and dues to January 1, 1929, including subscription to the JOURNAL.

COMING VETERINARY MEETINGS

Nevada State Veterinary Association. Reno, Nev. Jan. 2, 1928. Dr. Edward Records, Secretary, University of Nevada, Reno, Nev.

California State Veterinary Medical Association and University of California Veterinary Conference. University Farm, Davis, Calif. Jan. 3-4-5, 1928. Dr. W. L. Curtis, Secretary, 1264 W. 2nd St., Los Angeles, Calif.

Kansas Veterinary Medical Association. Wichita, Kans. Jan. 4-5, 1928. Dr. Chas. W. Bower, Secretary, 1128 Kansas Ave., Topeka, Kans.

Pennsylvania, Conference of Veterinarians, University of. Philadelphia, Pa. Jan. 4-5, 1928. Dr. Louis A. Klein, Dean, 39th St. & Woodland Ave., Philadelphia, Pa.

Tennessee Veterinary Medical Association. Jackson, Tenn. Jan. 4-5, 1928. Dr. A. C. Topmiller, Secretary, Box 238, Murfreesboro, Tenn.

Wisconsin Veterinary Medical Association. Madison, Wis. Jan. 9-10-11-12, 1928. Dr. B. A. Beach, Secretary, University of Wisconsin, Madison, Wis.

Intermountain Livestock Sanitary Association. Ogden, Utah. Jan. 10-11, 1928. Dr. W. D. Wright, Secretary, 312 Federal Bldg., Ogden, Utah.

Maine Veterinary Medical Association. Waterville, Me. Jan. 11, 1928. Dr. C. F. French, Secretary, Rockland, Me.

Ohio State Veterinary Medical Association. Deshler-Wallick Hotel, Columbus, Ohio. Jan. 11-12, 1928. Dr. W. R. Hobbs, Secretary, Ohio State University, Columbus, Ohio.

Virginia State Veterinary Medical Association. Richmond, Va. Jan. 12, 1928. Dr. Geo. C. Faville, Secretary, Hampton Institute, Hampton, Va.

Minnesota State Veterinary Medical Association. Minneapolis, Minn. Jan. 12-13, 1928. Dr. C. P. Fitch, Secretary, University Farm, St. Paul, Minn.

Cornell University, Twentieth Annual Conference for Veterinarians at. Ithaca, N. Y. Jan. 12-13, 1928. Dr. V. A. Moore, Dean, N. Y. State Veterinary College, Ithaca, N. Y.

Indiana Veterinary Medical Association. Hotel Severin, Indianapolis, Ind. Jan. 17-18-19, 1928. Dr. R. H. Boyd, Secretary, 1422 N. Capitol Ave., Indianapolis, Ind.

Iowa Veterinary Association. Savery Hotel, Des Moines, Iowa. Jan. 17-18-19-20, 1928. Dr. C. J. Scott, Secretary, Knoxville, Iowa.

Colorado Veterinary Medical Association. Denver, Colo. Jan. 18, 1928. Dr. R. F. Bourne, Secretary, Fort Collins, Colo.

Maryland State Veterinary Medical Association. College Park, Md. Jan. 19, 1928. Dr. E. M. Pickens, Secretary, College Park, Md.

Texas, State Veterinary Medical Association of. Texas Hotel, Fort Worth, Texas. Jan. 23-24, 1928. Dr. D. Pearce, Secretary, Leonard, Texas.

New Jersey, Veterinary Medical Association of. State College of Agriculture, University of New Jersey, New Brunswick, N. J. Jan. 24-25, 1928. Dr. G. P. Ellice, Secretary, 201 Hackensack St., East Rutherford, N. J.

Michigan State College Short Course for Veterinarians. East Lansing, Mich. Jan 23-24-25-26-27, 1928. Dr. Ward Giltner, Dean, East Lansing, Mich

Missouri, Short Course for Veterinarians, University of. Columbia, Mo. Jan. 24-25-26-27, 1928.

South Dakota Veterinary Medical Association. Cataract Hotel, Sioux Falls, S. Dak. Jan. 25-26, 1928. Dr. Ben Anderson, Secretary, Canton, S. Dak.

Connecticut Veterinary Medical Association. Hotel Garde, Hartford, Conn. Feb. 1, 1928. Dr. Geo. E. Corwin, Secretary, 11 Warrenton Ave., Hartford, Conn.

Oklahoma State Veterinary Medical Association. Huckins Hotel, Oklahoma City. Feb. 6-7-8, 1928. Dr. Frank R. Knotts, Secretary, Stillwater, Okla.

Southwestern Tuberculosis Conference. Oklahoma City, Okla. Feb. 7-8, 1928. Dr. C. H. Fauks, Secretary, 1919 W. Ash St., Oklahoma City, Okla.

Kansas State Agricultural College Conference for Veterinarians. Manhattan, Kans. Feb. 8-9, 1928. Dr. R. R. Dykstra, Dean, K. S. A. C., Manhattan, Kans.

Arkansas Veterinary Association. Little Rock, Ark. Feb. 9, 1928. Dr. T. M. Dick, Secretary, Little Rock, Ark.

Illinois Veterinary Conference, University of. Urbana, Ill. Feb. 13-14, 1928. Dr. Robt. Graham, University of Illinois, Urbana, Ill.

Southeastern States Veterinary Medical Association. Jacksonville, Fla. Feb. 14-15, 1928. Dr. J. I. Handley, Secretary, Box 1533, Atlanta, Ga.

BACTERIOLOGIC STUDIES ON THE ETIOLOGY OF PERIODIC OPHTHALMIA IN THE HORSE*

By EDWARD C. ROSENOW

Division of Experimental Bacteriology
The Mayo Foundation, Rochester, Minnesota

The incidence of periodic ophthalmia varies greatly in different localities and countries but has come to be considered as the common cause of blindness in horses the world over. Guard[1] reports that the percentage of blindness from this source is estimated to range from 4 to 70 per cent of the horse population of various counties and districts in Iowa. It is recognized by horse-breeders as the greatest curse to the horse industry today.

It is generally agreed that none of the many factors considered in the etiology, such as wet, impermeable, swampy, undrained soils; damp cold, basement stables, and insanitary conditions; fodders of a heating or starchy nature, such as corn, buckwheat or wheat; and improper balance of ration is adequate to explain the nature and occurrence of periodic ophthalmia. Most observers in this field believe that in addition to one or more of these factors, an infective agent is essential to explain all the facts. According to Law,[2] Vigezzi found in the aqueous humor a micrococcus, Trinchera and Koch a bacillus and a coccus, and Richter a diplococcus and a triplococcus. With these, the early symptoms are said to have been reproduced in individual instances. Avery[3] reports the production of the early symptoms by inoculating fluid from an affected eye into the anterior chamber of the eye of a normal horse. Bonazzi and Merillat[4] were unsuccessful in similar attempts at reproduction of the disease. Dalling[5] isolated from the optic nerve of horses suffering from attacks of specific ophthalmia a bacillus which was agglutinated by the serum of affected horses, an observation which Knowles[6] was unable to confirm. Judging from the author's description, the organism is clearly not like the one which I have isolated. Bonazzi and Merillat[4] report the isolation of a bacillus with which they appear to have reproduced the disease. Their description of the cultural and staining

*Presented at the sixty-fourth annual meeting of the American Veterinary Medical Association, Philadelphia, Pa., September 13-16, 1927.

reactions also indicates that it is not the organism which I have isolated.

In a preliminary note[7] I have reported the successful isolation of a peculiar organism from the interior of the eye and the conjunctival sac of horses affected with epizoötic periodic ophthalmia; the reproduction of the early stages of the disease by the direct intraocular injection (in a horse) of material from an acutely affected eye, proved to contain the organism; the tendency of the organism to localize in the eyes of rabbits when injected intravenously and the production of a powerful toxin having specific affinity for the ocular structures. The organism was described as a rather slender, Gram-negative, motile rod with rounded ends. It grows rather slowly aerobically on common culture media. On plain or glucose agar and plain horse-blood agar it produces medium-sized, glistening, translucent, non-adherent, yellow to orange colonies with smooth margins, and on potato, a spreading, confluent, yellow growth. The yellow pigment-formation is not so helpful for the isolation of the organism from mixed cultures as it would seem, for in some strains it does not develop until after forty-eight to seventy-two hours of incubation and may not appear at all where growth is heavy or where available oxygen is limited. In plain and dextrose broth it produees moderate diffuse clouding, most dense in the upper layer, and in older cultures a yellowish pellicle is formed. The pigment remains within the organism; fluorescence has not been observed. The organism produces no change in litmus milk, liquefies gelatin slowly, does not digest Loeffler's blood-serum, does not form indol, ferments sugars slightly without gas-production and reduces nitrates to nitrites. Its size and grouping vary considerably, depending on whether it is grown in liquid or solid media. It usually stains diffusely, although polar-staining and clear areas somewhat resembling spores occur in a few individual bacilli, especially in old cultures. On agar, the organism is quite uniform in size, ranging from 0.5 by 1.2 to 0.7 by 2.5 microns, and thread-formation is usually absent. In liquid cultures the length of individual rods varies considerably and short threads are sometimes seen. Flagella have not yet been demonstrated. Only a small proportion of the organisms are found actively motile, even in young cultures. The bacillus is not acid-fast. Young cultures are readily killed by heat and antiseptics. The organism grows rather slowly at 35 to 37° C., and somewhat more quickly at

room temperature; its optimal temperature for growth ranges between 25 and 30° C. According to Bergey's classification, the organism belongs to the genus *Flavobacterium* but it does not conform in all particulars to any of the numerous varieties described as peculiar to this genus.

Great difficulty has been experienced in isolating and maintaining the bacillus in pure culture. In cultures made by fishing well-isolated colonies from plates containing only characteristic colonies, smears of which revealed only Gram-negative bacilli and young subcultures of which proved to be pure, it has happened repeatedly that Gram-positive or Gram-negative, large or moderate-sized cocci or diplococci were found after the culture became old. The various forms found in these cultures, especially the large Gram-positive or Gram-negative diplococci, resembled closely the organisms commonly cultured with the bacillus from swabbings of the lacrimal sac and from material obtained from within affected eyes.

Further work has corroborated and extended the earlier observation in important respects. It is my purpose in this paper to describe the technic and to report the results of further attempts to reproduce the disease and of agglutination and immunization experiments.

Technic

In the earlier experiments the fluid from the anterior chamber of affected eyes was withdrawn with a 2-cc syringe fitted with a 25-gauge needle. It was difficult with this technic to avoid injury to the eye and possible contamination from the lids, and to see the position of the point of the needle within the anterior chamber, because both hands were required to manipulate the syringe. This difficulty was overcome by plugging the open end of the syringe with cotton, sterilizing the syringe with its attached needle, in the autoclave, and making suction with the mouth through a small rubber tube fitted at the distal end with a short piece of tubing large enough to fit snugly over the open end of the barrel.

The eye is anesthetized by placing in the conjunctival sac a few crystals of procain or a pledget of cotton soaked in a solution of 2 per cent butyn. The lids and surrounding skin are sterilized with 1:1000 solution of mercuric chlorid, and after the lids have been retracted with the thumb and fingers of the right hand, a few drops from a cotton sponge are placed in the conjunctival

sac. The nose is twitched, and the puncture made from the side about 5 mm. anterior to the attachment of the iris, without touching the lids. The right hand directing the barrel and needle is steadied against the side of the animal's head while the puncture is made and the fluid withdrawn. Care is exercised not to draw bubbles of air through the needle as it is withdrawn. Inoculation of media and of eyes of animals is made through the needle after it is throughly wiped with sterile gauze saturated with the mercuric chlorid solution.

Cultures were made from fluid aspirated from the anterior chamber of affected eyes and from emulsions (in sodium chlorid solution) of the exudate in the anterior chamber, and of the affected tissues. The eye of one horse which had been spontaneously affected was removed under chloroform anesthesia, and similar cultures were made from eyes experimentally infected and removed after death in a series of horses killed for this purpose or for the purpose of furnishing fresh meat for dogs.

The fluids of the eye and the emulsions of the exudate and of affected tissues were inoculated routinely on the surface and in the water of condensation of horse-blood agar plates and slants prepared with beef extract or infusion agar; on Loeffler's medium and slants of alfalfa or bean-infusion agar into low columns of soft meat-infusion agar (0.7 per cent) and into tall columns of 0.2 per cent glucose-brain broth and in soft agar and glucose broth. One or more of these media were inoculated in duplicate, one to be incubated, and the other kept at room temperature. Parts of the fluid and of the emulsions were preserved in the ice-chest for later cultures. Cultures from these were often positive weeks later and sometimes yielded growth when the primary cultures proved negative.

The tissues of affected eyes were fixed in 10 per cent formalin and imbedded in paraffin, and sections stained with hematoxylin and eosin for lesions and by a modified Gram method and with methylene blue and eosin.

At first, cultures of swabbings from the conjunctival sac were made on the surface of beef extract or meat-infusion agar slanted twenty-four hours previously in large tubes or spread out in poured plates. Later, it was found that the organism grew more luxuriantly on bean or alfalfa-infusion agar and these media were used as a routine instead. These infusions were made exactly as is meat infusion, by passing equivalent amounts of each through a meat-chopper, and infusing in the usual manner.

Alfalfa, fresh or as dried hay, and string beans, with or without the plant, have been found satisfactory.

The cotton swab on one end of a wood applicator, with which the conjunctival sac was swabbed, was broken off in the mouth of the test-tube, brought in contact with the water of condensation and allowed to soak for from one-half to two hours, when the tube was shaken and the surface inoculated by flowing the water of condensation over it. It was found far better to transport the swab in an empty test-tube than to inoculate media and to transport these, for overgrowth of saprophytes was effectively prevented. The cultures from feeds such as oats, ground feeds, corn and hay were made by suspending about 1 gm. of each in 5 cc of sodium chlorid solution, shaking thoroughly and inoculating the water of condensation in the large tubes of agar slants with from one to five drops of the washings, flowing it over the surface and plating similar amounts on agar plates.

Cultures from suspected water, usually containing pieces of moss, were made by inoculating one to five drops from a small pipette onto the large agar slants and on agar plates. The cultures were incubated at from 33 to 35° C. for one or two days and then kept at room temperature for several days longer. Characteristic colonies rarely developed within forty-eight hours and in many suspected colonies yellowish pigment did not form until one or more days at room temperature. If no characteristic colonies developed on the surface of the agar slants in four or five days, smears were made of the water of condensation and, if the suspected organism was not found, the culture was discarded as negative; if it was found, wide platings were made for identification.

Results of Cultures of Material from within Affected Eyes

The fluid from the anterior chamber was aspirated and cultured from one or both eyes of eleven horses that contracted the disease spontaneously and from the eyes of sixteen horses in which the disease was induced experimentally.

The cultures in five of the spontaneously affected horses yielded the characteristic bacillus, together with a pleomorphic Gram-positive or Gram-negative diplococcus in three cases, usually arranged in twos but sometimes in short chains or as single cocci. At the time of puncture, the symptoms were

marked in all and had existed from three days to six weeks. A membranous exudate and highly turbid fluid were present in the anterior chamber in all but one. Smears made in four of these showed a few round cells and a preponderance of leucocytes, and in two a few small Gram-negative bacilli and diplococci were demonstrable.

The cultures from the fluids of the remaining six spontaneously affected horses failed to yield the characteristic bacillus. A few colonies of staphylococci were obtained in two and an aerobic spore-bearing bacillus in two. These were found to be without virulence and hence were considered as accidental contaminations. The symptoms referable to the eye were relatively acute in three of these six and only slight in three. The attacks in question had existed for from one to four weeks and the disease from six weeks to several years prior to aspiration and the fluids were only slightly turbid or entirely clear. Two horses had been blind for several years.

The eleven affected horses whose eyes were punctured represent four herds in four states: New York, Maryland, Wisconsin and Minnesota. In all but two of the sixteen experiment animals the anterior chamber of the eye had been inoculated under local anesthesia. In the remaining two, and in four others in which intraocular injection was made later, an attempt was made to produce the disease by merely introducing the organism into the conjunctival sac. Of the fourteen injected intraocularly, four had received sterile filtrates of old cultures and one a filtrate of an emulsion of the iris and exudate of the eye of a horse injected with a culture. Cultures in three of these remained sterile while one yielded a hemolytic streptococcus, undoubtedly extraneous, since a boiled filtrate of culture had been injected. Four received directly the fluid or emulsion of exudates of affected eyes. The characteristic bacillus was isolated in two and a diplococcus in two. The remaining five received a pure culture of each of four different strains of the bacillus. In these, all cultures made in from one to three weeks from emulsions of exudate or of affected tissues yielded the bacillus, in pure form or in mixture with cocci. The fluid in the anterior chamber was usually sterile if cultures were made a week or ten days after inoculation. This was sometimes true when emulsions of exudate and affected tissues yielded large numbers of colonies.

The eye of one horse (702), on the third day of the third spontaneous attack, was removed under chloroform anesthesia for culture and animal inoculation. Cultures of swabbings taken before the operation from the conjunctival sac of the normal eye yielded the bacillus, those from the affected eye did not. The cultures of the fluid from the anterior chamber of the affected eye were sterile. An emulsion of the exudate covering the iris and emulsions of the iris, uveal tract and limbus yielded a preponderance of Gram-positive and Gram-negative diplococci and a smaller number of the characteristic bacilli. From one horse suffering with acute symptoms in the right eye for one month and in the left eye for two weeks, but with clear aqueous humor, the characteristic bacillus, together with the diplococcus, was isolated from the fluid of both eyes, from swabbings of the conjunctival sacs of both eyes and from the right nostril. Part of the fluid and emulsion of the exudate from this eye were inoculated into the eyes of horse 708. Cultures from the eyes of two horses that had been blind for years and were killed failed to yield these organisms, but in one tube a large Gram-positive coccus, believed to be from contamination, was obtained from an emulsion of the scar tissue in the region of the iris surrounding a cloudy shrunken lens.

Cultures from swabbings of the conjunctival sac in the inoculated animals proved of interest. This culture was made as a routine before injection and at intervals after injection. The characteristic bacillus was not obtained in any before inoculation, nor from affected eyes inoculated with sterile filtrates, whereas in animals inoculated with cultures of the bacillus or with fluids or emulsions of exudate or tissue from affected eyes, it was isolated in seventeen of forty-one cultures made.

Cultures were made of the blood of seventeen spontaneously affected horses. These remained sterile in fourteen, while three yielded a contaminating staphylococcus. In order to rule out syphilis of horses as the cause of the condition in the eyes, complement-fixation tests were made for me by Dr. Sanford with the serum of affected horses. The results were negative in all of twelve affected animals and of five normal controls. The serum of one control horse was anti-complementary.

The common presence of these widely different organisms in affected eyes and in old cultures of the bacillus has been a puzzling problem, not only as regards the pathogenesis of the disease but also from the bacteriologic standpoint. The appa-

rent mutations noted occurred haphazard and in liquid media and always in one direction, from bacillus to coccus forms, and could not be induced at will. Hence, the possibility of inadvertent mixtures or contaminations could not be ruled out. However, some time ago mutation in the opposite direction, from diplococci to bacilli, occurred within well-isolated colonies of the diplococcus on a plain agar plate under conditions which would seem to rule out contamination and hence prove a true mutation of "dissociation" (Hadley). The observation is deserving of a detailed statement of the conditions.

June 27, the growth showing in smears Gram-positive diplococci and cocci in glucose-brain broth, inoculated forty-eight hours previously with the fluid from the anterior chamber of an acutely affected eye, was plated widely on the surface of a meat-infusion agar plate. This was placed in the incubator at a temperature of 35° C. June 28, the plate showed a pure growth of small, translucent, non-adherent, grayish colonies of Gram-positive diplococci. The plate was again incubated at 35° C. June 29, again only typical diplococcus colonies were found. The plate was then kept at room temperature. June 30, an interesting picture had developed. The part of the plate most heavily inoculated still showed only the small translucent colonies of Gram-positive diplococci, but where the colonies were the fewest, typical moist, glistening, lemon-yellow, more opaque and somewhat larger colonies had developed. All of these had grown from the smaller colonies of Gram-positive diplococci. Nearly all had changed but, as the number of colonies became larger in the direction of the heavily inoculated part of the plate, the number of yellow colonies decreased as typical colonies of Gram-positive diplococci increased. The distribution of the yellow colonies was such as to rule out the possibility of contamination from the plate or from the air. Smears were made of eleven of the newly-developed yellow colonies. All showed large numbers of typical small Gram-negative bacilli, as well as a smaller number of Gram-positive and Gram-negative diplococci. Smears were then made from the periphery and the center of four additional yellow colonies and of four typical smaller grayish translucent colonies of Gram-positive diplococci. The latter four revealed Gram-positive diplococci only; the periphery of the former showed Gram-negative bacilli with almost no Gram-positive diplococci and the center a preponderance of Gram-negative bacilli but also large numbers of Gram-

positive diplococci. Smears made from confluent colonies in the heavily seeded parts of the plates showed Gram-positive diplococci only. Fishings from four yellow colonies, after incubation for twenty-four hours, were then plated on blood-agar plates. All showed a large number of typical yellow colonies of small Gram-negative bacilli, and on two plates a moderate number of greenish colonies of Gram-positive diplococci also developed. These plates were examined daily for a week. Mutation was not observed. Subcultures in broth, diluted 1:1000, derived from single colonies of the bacillus and the diplococcus on the blood-agar plates, were injected into the eyes of horse 54. The former produced a marked, the latter a moderate reaccion. Cultures made from turbid fluids aspirated forty-eight hours later yielded pure growths of the respective strains. The fluids on the sixth day, when the horse was killed, proved sterile. Cultures from the exudate of the right eye injected with the diplococcus yielded a large number of Gram-positive diplococci only, whereas those from the exudate in the left eye, injected with the bacillus, yielded a few colonies each of the Gram-negative bacillus and the Gram-positive diplococcus.

Results of Cultures from Conjunctival Sac

A summary of the results of cultures made from the conjunctival sac in horses is given in table I. It will be seen that

Table I—*Incidence of isolation of characteristic bacillus from conjunctival sac in horses*

	Condition	Herds	Horses	Positive	
				No.	%
Normal horses	In unaffected herds	7	52	4	7.5
	In affected herds	11	100	12	12
	Total	18	152	16	10
Affected horses	With active ocular symptoms	7	27	19	70
	With dormant ocular symptoms	8	33	11	30
	Total	11	60	30	50

the incidence of isolation of the characteristic bacillus was lowest (7.5 per cent) from the eyes of normal horses in unaffected herds and somewhat higher (12 per cent) from the eyes of normal horses in affected herds. The total incidence of isola-

tion of the characteristic bacillus from 152 normal horses, representing eighteen herds, was sixteen (about 10 per cent). This was in sharp contrast to the high incidence of its isolation from the eyes of affected horses. Of the sixty affected animals, representing eleven herds, cultures from thirty (50 per cent) yielded the organism. The organism was cultured from nineteen (70 per cent) of the twenty-seven animals in which the eyes showed active symptoms, such as photophobia, lacrimation, congestion and swelling of the lids, whereas it was cultured from eleven (33 per cent) of the thirty-three affected horses in which the condition of the eyes was dormant at the time of culture.

Results of Cultures from Feed

In order, if possible, to determine the source of this organism, cultures were made from different feeds, especially oats and hay, and water. Poorly cured oat and pea hay was suspected as the source by the owner in one outbreak, poorly cured alfalfa hay in another and mouldy corn in a third. The bacillus was isolated from each of these feeds. A summary of results of cultures made of feeds obtained from seven uninfected and ten infected farms is given in table II. The water in all cases was obtained from

Table II—*Incidence of isolation of characteristic bacillus from feeds*

Samples from	Feeds	Samples Cultured	Positive	
			No.	%
Uninfected farms (7)	Oats	11	2	18
	Hay	6		
	Water	5		
	Total	22	2	9
Infected farms (10)	Oats	14	8	57
	Hay	17	7	41
	Water	8	4	50
	Total	39	19	49

the tubs or troughs supplying the water. The total average incidence of isolation of the characteristic bacillus from samples of oats, hay and water, from farms where the disease did not exist, was 9 per cent, which is in sharp contrast with 49 per

cent in farms where one or more horses were affected. In some instances there seemed a close relation between the condition of the feeds and the occurrence of the disease; in others there seemed no relation. Three samples of recently threshed oats which had been fed for only a few days were found to contain large numbers of the bacillus. Two of these were from farms where the disease had existed for some months, while the third was from a neighboring farm where the horses were not affected. Cultures from the feeds and water, in addition to showing the characteristic bacillus, often yielded cocci, diplococci and staphylococci.

In an outbreak in New York where thirty-three of seventy-five horses had become affected during four months previous to my study, the organism was repeatedly isolated, and in large numbers, from two samples of oat and pea hay which was being fed when the epizoötic began. It was obtained also from the water of two drinking-tubs, from one sample of shavings used in an open stall for bedding and from the depths of the soil in the horse-yard, but not from the water directly from the well, from timothy hay, from grass in the pasture, from buckwheat straw or from freshly opened bales of shavings.

In another outbreak in Maryland which had begun one and one-half years previously and where some animals continued to suffer recurring attacks, the characteristic organism was isolated in large numbers in repeated cultures from two samples of poorly cured alfalfa hay harvested in 1925, and fed at the time when the epizoötic began. Similar cultures from alfalfa and timothy hay harvested in 1926 failed to yield the organism.

At a farm in Wisconsin where one of a herd of ten horses had contracted the disease a month before my study, the organism was isolated from both eyes of the affected animal, from one eye of the normal team-mate and in large numbers from all of three samples of oats, from one sample of ground oat feed, and from one of two samples of water obtained from the shady side of the water-trough. It was not obtained from the eyes of the remaining eight normal horses or from two samples of new hay, one sample of new oats, one of grass and one of wheat. Cultures made on the same day from these feeds from four farms where the disease had not occurred failed to show the organism.

On another farm where one horse had developed the disease a short time previously, the bacillus was isolated from the

affected eye, in large numbers from the oats and bran and in small numbers from the hay and the water from the drinking-trough. The water from the well and from peat moss used as bedding, and swabbings from the eyes of nine normal horses failed to yield the organism.

At one farm in Minnesota where four of twelve horses contracted ophthalmia during the six months before my study, the organism was isolated from one or both eyes of the four affected animals, from one eye only of one of the eight normal animals and from both of two samples of hay and of two samples of oats. It was not obtained from two samples of water containing moss from the shady side of the drinking-trough.

At another farm it was isolated in August from samples of suspected mouldy corn which the animals were fed in early spring during the time when three contracted the disease, and was not obtained from the oats or hay.

Animal Experiments

The clue which has led to the isolation of the peculiar bacillus herein described was obtained through the use of three rabbits. The cultures from the conjunctival sacs of three affected horses, sent me by Dr. F. Park Lewis, of Buffalo, had become so badly contaminated in transit that it seemed hopeless to isolate a possible causative organism by plating methods. Accordingly, mass cultures were made in glucose-brain broth and these injected intravenously in 5-cc amounts, in the hope that saprophytic organisms would perish and the causative or virulent organism could be isolated from the specific tissue—the eye—or from the blood of the injected animals, just as we have done so often following injection of mixtures of bacteria from foci of infection in diseases affecting human beings. One of the rabbits remained well; two died during the night following inoculation. Cultures from the aqueous humor and blood of these two animals yielded yellowish glistening colonies of small Gram-negative bacilli, the like of which I had never before seen. This method has led to the isolation of the bacilli many times since, when cultures were badly contaminated, the blood usually, the eye less often, yielding a pure culture of the organism. Not only has the living organism affinity for the eye but it produces an extremely potent toxin which, aside from general toxicity, affects specifically the ocular structures of the horse, rabbit, guinea pig and white rat following intravenous injection. The

effect of cultures and filtrates on the rabbit is especially characteristic, and the reaction obtained is used to assist in the identification of suspected strains (fig. 1). Soon after intravenous injection of 0.2 cc of broth culture or filtrate for each 100 gm. of body weight, the animal becomes prostrated, manifesting increased respirations and weakness of extremities, often associated with fine tremors of muscles, especially on exertion, and coincidentally congestion of the vessels of the palpebral conjunctiva and of the iris appears and especially of the circumcorneal vessels, accompanied by a variable degree of lacrimation. Similar, although milder, symptoms have followed intravenous injection of as little as 0.1 cc in rabbits weighing 2000 gm. If the animal succumbs following injection, either of living cultures or of filtrates, death usually occurs within forty-eight hours, more often within twenty-four hours, and the congestion of the

FIG. 1. Drawing of eyes of rabbits. Left, normal; right, showing marked circumcorneal congestion of vessels, ten hours following intravenous injection of a broth culture of the characteristic bacillus, after twelve subcultures and passage through one animal.

eyes continues until death. If recovery ensues, the symptoms usually reach their maximum in from six to twelve hours and disappear completely in from two to four days following injection of cultures and within one or two days following injection of filtrates. Characteristic symptoms, including those of the eye, were noted in nearly all of ninety-eight rabbits injected with 2 cc of mixed or pure cultures representing twenty-six different strains. Of these, sixty-seven (68 per cent) died. Cultures from the blood made after death in fifty-one animals yielded a pure growth of the bacillus in twenty-two and a mixed growth with *Bacillus coli*, staphylococci or *Bacillus bronchisepticus* in ten additional animals. The blood was never heavily seeded. The liver and spleen sometimes yielded the organism when cultures of blood and eye were negative. Cultures were made from the fluid of the anterior chamber of forty-

four rabbits which succumbed to intravenous injection of the bacillus. Of these, fourteen yielded the bacillus in pure culture. In five of the rabbits which survived injection with living cultures, reaction of the eyes progressed and signs of inflammation of the internal structures due to localization of the organism developed, such as congestion of iris, turbidity of fluid and exudation in the anterior chamber. In these the symptoms usually persisted for weeks, resulting in loss of sight in the affected eye due to clouding of the cornea, the aqueous humor and the crystalline lens. The early symptoms following injection of filtrates of broth cultures of the bacillus were similar to those produced by injection of cultures, but they disappeared earlier and in no instance did late signs of infection of the internal structures develop. Of forty-one rabbits injected with twenty-two strains (0.2 cc for each 100 gm. of body weight) nearly all developed characteristic symptoms; of these twenty-four (58 per cent) died. Cultures of the blood were sterile.

Intraocular injections of 0.5 cc of culture or filtrate into rabbits under ether anesthesia have been found to induce a condition that resembles closely that noted in acute spontaneous attacks in horses, except that resolution with complete recovery of the eye ensues in from one to four weeks, depending on the size of the dose and the virulence of the strain injected. Filtrates cause a similar acute reaction, manifested by extreme congestion, lacrimation, clouding of the aqueous humor and formation of a membranous exudate in the anterior chamber, which results in temporary loss of vision, but recovery occurs more quickly than following injection of cultures. The toxin in both its general and its specific effect on the eye is very stable. It does not deteriorate noticeably when preserved in the ice-chest or at room temperature for many weeks. Heating to 60° C. for two hours does not reduce its toxicity and boiling reduces it only slightly. Autoclaving cultures for as long as two hours, followed by filtering, does not destroy the toxicity completely although it reduces it markedly.

Control injections in like dosage of sodium chlorid solution, of sterile broth, and of cultures and filtrates of other organisms isolated from affected animals, were made intravenously and intraocularly in rabbits and intraocularly in horses. Reactions were absent or slight. Diluted cultures and filtrates of staphylococci, diphtheroid bacilli and colon bacilli sometimes isolated, manifested no specificity for the eye. Cultures and filtrates of

the Gram-positive or Gram-negative diplcoöccus cultured repeatedly with the characteristic bacillus, and sometimes isolated in pure culture from the eyes of affected horses, had moderate affinity for the eyes of rabbits when injected intravenously. When injected in approximately five times the dosage of bacilli used, the diplococcus produced congestion similar to but milder than that which followed injection of cultures or filtrates of the bacillus. Constitutional symptoms were nearly always absent and congestion of vessels of the eye lasted usually only a few hours. The effects of intraocular injection in horses (fig. 2) and in rabbits were also less pronounced and recovery occurred more promptly.

The horse has been found to be extremely susceptible to young cultures and to sterile filtrates of old cultures of the bacillus: 0.3 cc of the culture for each kilogram of weight

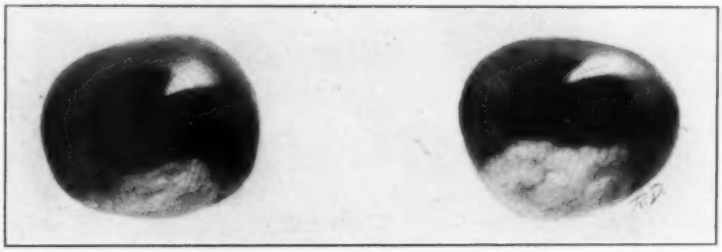

FIG. 2. Fibrinous exudate in lower part of anterior chamber of the eyes of horse 54, six days after injection with a 1:1000 dilution of a culture in broth (sixth subculture) of the bacillus (right) and diplococcus (left) isolated from the fluid of the anterior chamber of the eye of a horse suffering from an acute attack of periodic ophthalmia.

injected intravenously has proved fatal within a few hours in one horse and in twenty-four hours in another, the organism being isolated in pure culture, but in small numbers, from the blood and the fluid from the anterior chamber in both. In the horse that lived for twenty-four hours marked circumcorneal congestion and lacrimation developed and a hemorrhagic area appeared in the iris of one eye.

The injection of 4 cc of filtrate used for immunization, 2 cc intracutaneously and 2 cc subcutaneously, often causes general and local symptoms in horses weighing 600 kg. or more. Within from one-half to one hour, about half of the animals manifested signs of intoxication by alternately resting one hind foot and the other, by lying down and by moderately increased and sighing respiration, while in a smaller number congestion of the vessels of the eyes appeared, especially those of the lids and

those surrounding the cornea. Fifty cubic centimeters of a highly toxic filtrate prepared from a mixture of strains and boiled for one hour has produced weakness and marked circumcorneal congestion and lacrimation in an adult animal.

From 0.2 to 0.5 cc of filtrate of cultures introduced into the anterior chamber causes marked congestion, photophobia, lacrimation and swelling of the lids within a few hours, marked

FIG. 3. Condition of inoculated eye (top) and uninoculated eye (bottom) of horse 45, injected twenty days before with a suspension (diluted in sodium chlorid solution) of the bacillus isolated from the eye of horse 708 after seven subcultures. Note the diffuse clouding of the cornea and the fluid in the anterior chamber, and edema of the lids in the inoculated and the normal condition of the uninoculated eye.

clouding of the fluid in the anterior chamber within twenty-four hours, and the appearance of a fibrinous exudate within forty-eight hours. Following this, the reaction subsides and complete recovery ensues, usually within a week. Similar, although less severe, reactions follow injection of fluids, emulsions and filtrates of emulsions of exudate or affected tissues

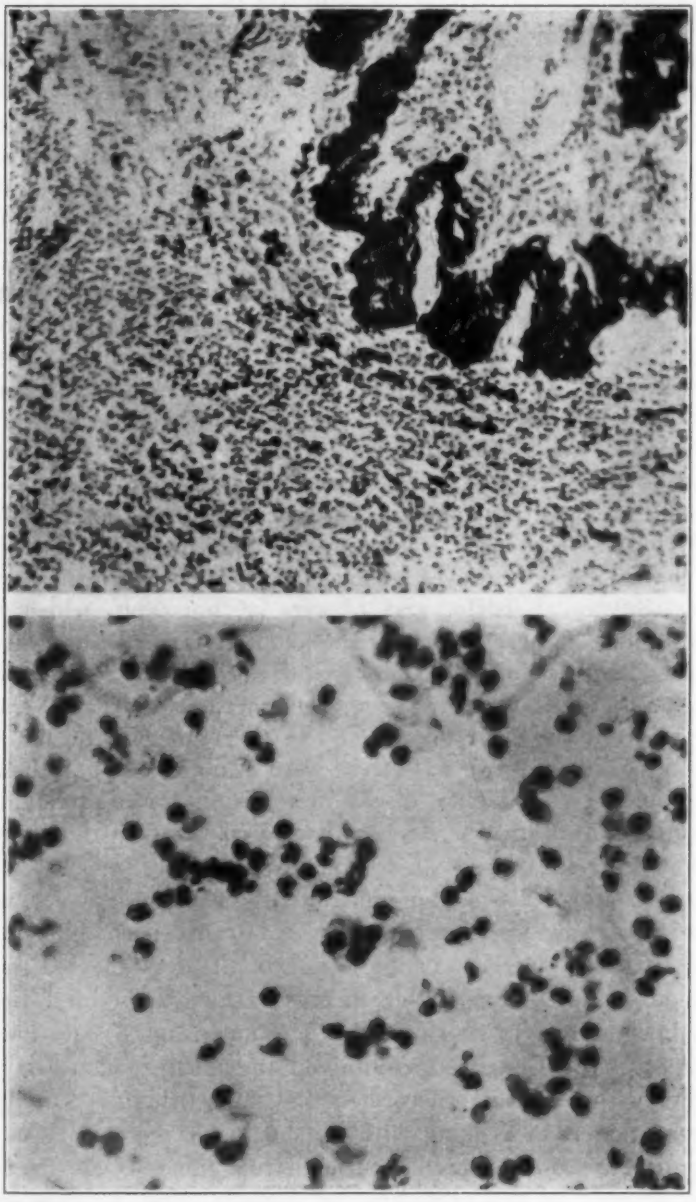

FIG. 4. (Above) Edema and cellular infiltration of ciliary body of the eye of horse 702, removed on the third day of the third acute attack. (Hematoxylin and eosin. x 120.)

FIG. 5. (Below) Higher magnification of a small area shown in figure 4. Note the great preponderance of polymorphonuclear leucocytes. (Hematoxylin and eosin. x 300.)

from acutely affected eyes. If cultures of these injected materials prove negative, the reaction is transient; if positive, the reaction tends to persist for a long time. (Protocol of horse 708.) Five-tenths of a cubic centimeter of the undiluted, as well as of highly diluted (1:1000) cultures of the bacillus have sufficed to induce typical acute attacks and a condition identical with the spontaneous disease, lasting for weeks and associated with exacerbations and remissions. (Protocols of horses 708 and 46.)

The early symptoms have been reproduced in the horse by inoculating pure cultures of the bacillus, undiluted and diluted as high as 1:1000 with sodium chlorid solution, isolated from the fluid or exudate of affected eyes, from swabbings of the conjunctival sac in normal and affected horses, and from feeds and water. This has been accomplished with the bacillus after as many as ten subcultures, each successive culture being made from a single colony. The organism has been passed successively through four horses by intraocular inoculation, producing characteristic early symptoms in each instance. Sections of the tissues of the eyes removed from horse 702 which were affected spontaneously, and of eyes of horses in which the disease has been reproduced experimentally (fig. 3), have been studied microscopically. Congestion of vessels, edema and leucocytic infiltration are most pronounced in the uveal tract, the iris and the ciliary body, and in the region of the limbus. The lesions in the two conditions were similar in type, although those of the experimental disease were usually more pronounced (figures 4, 5, 6 and 7). In the choroid coat and in the cornea, milder changes were found, consisting of localized areas of hemorrhagic or leucocytic infiltration. The optic nerve and the retina were free from infiltration. It has been difficult to find bacteria, especially in the lesions of the eyes affected spontaneously, but prolonged search has revealed undoubted diplococci, sometimes in short chains and clumps (fig. 8) and bacilli morphologically like those obtained in cultures, alone or together with cocci or diplococci in the same field (fig. 9). This observation is in keeping with the fact that the two types of organism are often isolated in cultures from affected eyes (fig. 10). The scarcity of the organisms in sections, even of eyes that showed marked reactions relatively soon after injection of pure cultures, is in keeping with the small number of colonies isolated in cultures. The experimental results are illustrated in

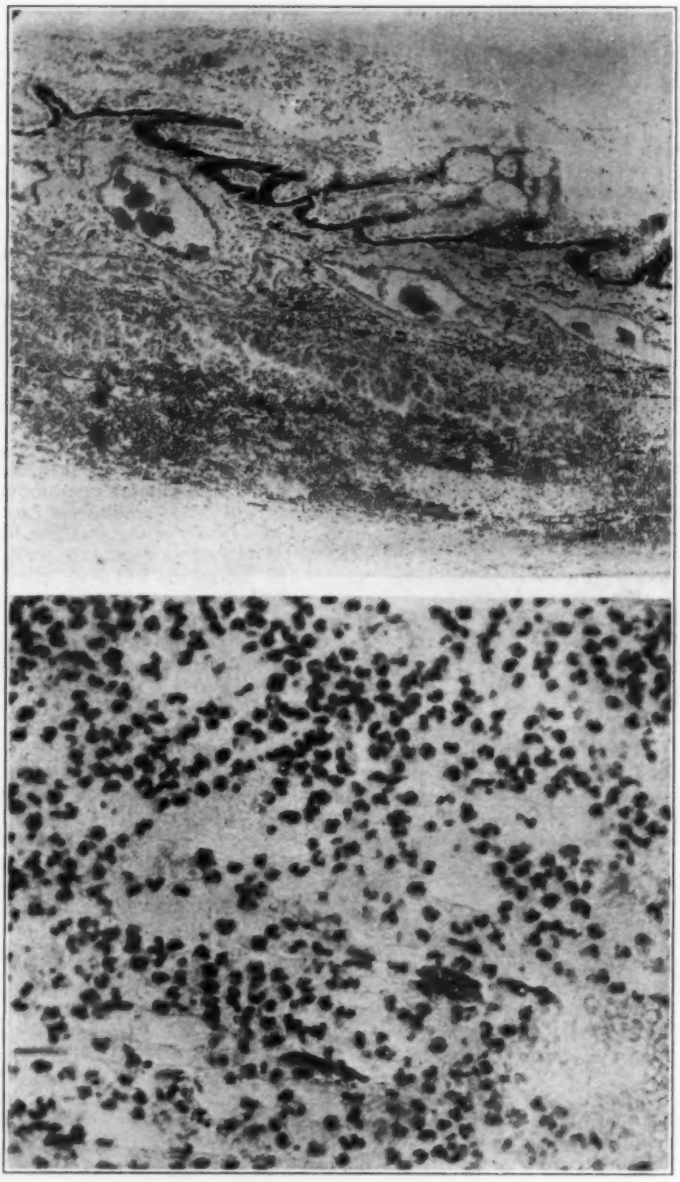

FIG. 6. (Above) Section through ciliary body of affected eye shown in figure 3. Note the marked edema and hemorrhagic and cellular infiltration. (Hematoxylin and eosin. x 50.)

FIG. 7. (Below) Higher magnification of a small field shown in figure 6. Note the great preponderance of polymorphonuclear leucocytes. (Hematoxylin and eosin. x 300.)

the following protocols of the two horses which have been longest under observation.

Horse 708 was a medium-sized gelding, about sixteen years of age. The eyes were normal, the animal was well and in fair nutrition.

May 2, 1927, at 5 p. m., cultures were taken from the conjunctival sac. The eyes were anesthetized with procain, the lids and conjunctival sac sterilized with chloromine solution, and approximately 0.5 cc of the fluid from the anterior chamber of the affected eye of horse 702 injected into the anterior chamber of the right eye, and an equal amount of an emulsion, in sodium chlorid solution, of the exudate covering the iris injected into the left eye. Two cubic centimeters of a mixture of the fluid and emulsion of the exudate from the iris, uveal tract and limbus was injected into and under the skin of the left shoulder. Skin tests were made with filtrates of old cultures of the bacillus (strains 698 and 701) and a sterile broth control, by injecting 0.2 cc of each in a 1:10 dilution in sodium chlorid solution into the skin of the left shoulder.

May 3, at 9 a. m., moderate photophobia, lacrimation, conjunctival and circumcorneal congestion and turbidity of fluid, more marked in the left eye, were apparent. No swelling was seen at the point of injection (left shoulder) of the mixture of fluid and emulsions of exudate and tissues. There was a swelling of the skin 2 cm. in diameter surrounding the point of injection of the diluted filtrates, but none where the broth was injected. At 6 p. m. the condition of the eyes was worse. The lids were swollen and the fluid in the anterior chamber was markedly turbid. A cloudy film covered the lower half of the iris of the left eye. Swabs were taken from the conjunctival sac, and fluid was aspirated from the left eye and cultured.

May 4, the condition of the eyes remained about as on the preceding day. Swellings were absent at the point of the skin tests. The animal was shipped from New York to Rochester.

May 7, lacrimation, circumcorneal congestion and turbidity of the fluid in the anterior chamber were moderate but more marked in the left eye. There was a fibrinous exudate over the anterior aspect of the iris of the left eye but none over the right. The lens was clear and the pupils reacted to light. Cultures were taken from the conjunctival sacs of both eyes.

May 9, the condition of the eyes remained unchanged. Cultures of the swabs taken before injection failed to show the bacillus, while those taken the day after injection yielded the bacillus from the left eye but not from the right. Cultures of the fluid from the left eye on a blood-agar slant yielded the characteristic bacillus.

May 10, the condition of the eyes was worse. Marked photophobia, lacrimation and circumcorneal congestion were present and there was a turbid exudate in the lower half of the anterior chambers of both eyes. Cultures made from the conjunctival sac (May 7) were negative.

May 15, the eyes were much improved. There was no photophobia; lacrimation was absent in the right eye and slight in the left. The fluid in the anterior chamber of the right eye was clear with no exudate; the fluid of the left eye was slightly turbid and a thin film covered the anterior aspect of the lower half of the iris. There was bluish discoloration of the cornea.

May 31, both eyes appeared normal. Twenty cubic centimeters of blood were withdrawn from the jugular vein.

June 12, eyes were normal.

June 16, eyes were normal. The conjunctival sac was cultured.

June 22, eyes were normal. Several colonies of typical Gram-negative bacilli were isolated from the swabs made from the right eye, June 16. Cultures from the left eye were negative.

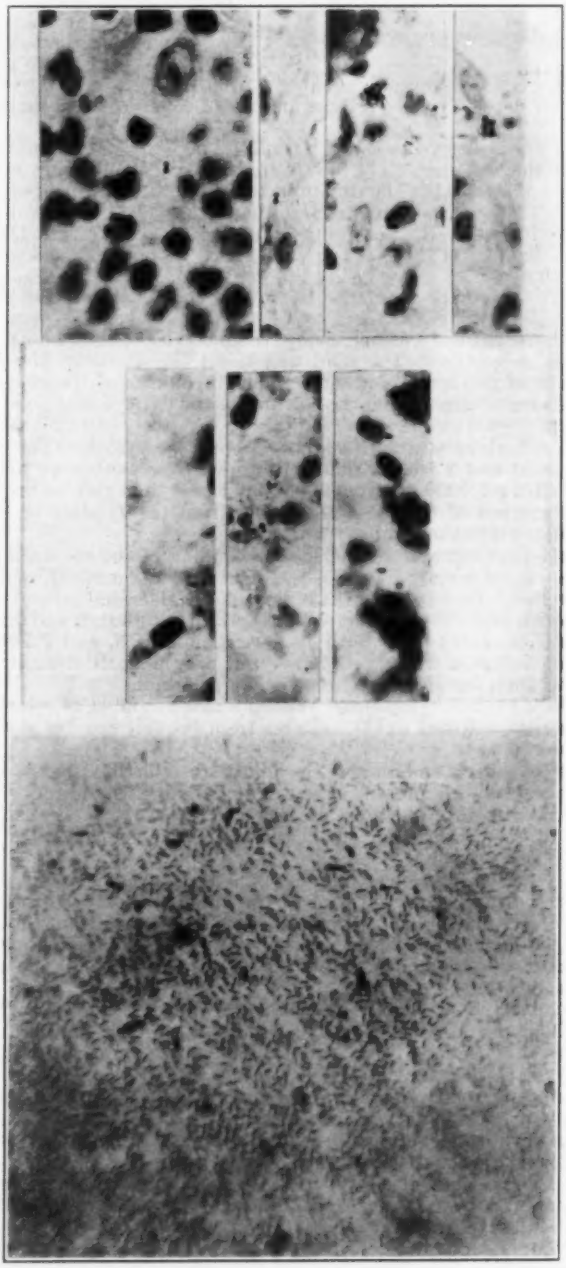

FIG. 8. (Above) Single diplococcus in the wall of a capillary, free in the tissue, and in short chains and clumps in the section shown in figure 4. (Methyleneblue and eosin. x 1000.)

FIG. 9. (Center) Bacilli alone and together with small and large diplococci and cocci in the lesions of the eye of horse 702 shown in figures 4 and 5.

FIG. 10. (Below) Bacilli and diplococci of different sizes, isolated from the turbid aqueous humor of the inoculated eye shown in figure 3.

June 28, eyes were normal. Swabs were taken from the conjunctival sacs.

July 1, eyes were normal. Cultures from the right eye were negative; those from the left yielded a large number of colonies of the characteristic bacillus.

July 6, the right eye appeared normal. There was an undoubted recurrence in the left eye. The lids were slightly swollen and congested. Moderate photophobia, lacrimation and circumcorneal congestion were present. There was no evidence of injury to the eyes. There was a watery discharge from the left nostril but none from the right. The fluid in the anterior chamber of the left eye was slightly cloudy. Swabs were taken from both eyes.

July 7, the condition of the left eye was unchanged; the right was normal. Swabs were taken.

July 9, the left eye was improving; there was less photophobia, lacrimation and congestion. The fluid was clear; the fibrinous film over the lower half of the iris was absent. Several colonies of the characteristic bacillus were obtained from the cultures of the left eye, but none from the right.

July 14, both eyes were normal; swabbings were taken. The eyes were anesthetized and 1.5 cc of fluid withdrawn from both eyes for culture, and 0.5 cc of a 1:1000 dilution of a 24-hour growth in glucose broth, in the fifth subculture of the bacillus isolated from the exudate of horse 702 was injected into the right eye.

July 15, the left eye was normal. Clouding of the cornea and of the fluid in the anterior chamber of the right eye was marked, and the lids were swollen. There was marked photophobia, lacrimation and discharge of yellowish pus. The eyes were anesthetized with butyn and disinfected. The anterior chambers of both eyes were punctured, and 1.5 cc of clear fluid was obtained from the left eye but only a small amount could be aspirated from the right eye because of a gelatinous exudate. Swabbings taken July 14, before injection, yielded a small number of colonies of the characteristic bacillus in the cultures from the left eye but not in those from the right eye.

July 16, moderate swelling of the lids, marked lacrimation, photophobia and congestion were present in the right eye, and the anterior chamber was filled with turbid yellowish exudate.

July 19, the condition of the eyes remained unchanged. The conjunctival sac was swabbed.

July 21, the left eye was normal. The right eye was about as of July 16. The cultures from the fluid of the anterior chamber of the left eye were sterile. Cultures of a small amount of exudate from the right eye on a blood-agar slant yielded a few colonies of the characteristic bacillus. Cultures of the swabbings taken July 14 were negative for the characteristic bacillus.

July 23, the condition of the eyes was unchanged. Cultures of the swabbings from the left eye yielded a moderate number of colonies of the characteristic bacillus; those from the right eye were negative.

July 30, the left eye appeared normal with no clouding of the lens. There was marked reaction of the right eye and the lids were swollen and held closed continuously. Lacrimation was marked and there was an exudate in the anterior chamber which was hemorrhagic in areas.

August 1, the left eye was normal. Marked lacrimation, swelling of lids and circumcorneal congestion of the right eye were present. The pupil and iris were completely obscured by a yellowish, membranous exudate in the anterior chamber. The cornea was clouded and numerous small vessels could be seen extending inward from the periphery for a distance of from 5 to 7 mm.

August 5, the right eye was greatly improved. The photophobia and lacrimation, the swelling of the lids, the turbidity of the exudate in the anterior chamber and the circumcorneal congestion were less marked. Swabs were taken for culture.

August 10, the condition of the right eye was about as on August 5. Cultures of the swabbings were negative.

August 15, the condition of the right eye had become worse. Lacrimation, photophobia and circumcorneal congestion were marked. The exudate in the anterior chamber was hemorrhagic and the cornea clouded. There were many vessels extending into the cornea for a distance of 1 cm. The left eye was normal except for two areas of clouding, about 3 by 5 mm., in the crystalline lens.

August 25, the right eye was somewhat improved. There was less swelling of the lids, lacrimation and congestion. The exudate in the anterior chamber was less hemorrhagic and was yellowish and opaque throughout. The vessels in the cornea were less conspicuous. The areas of clouding in the left lens remained unchanged.

Horse 46 was a black, high-spirited racer, of medium weight and about twelve years of age. The animal had never had disease of the eyes.

May 24, 0.2 cc of the water of condensation of a Loeffler's blood-serum slant, which had been inoculated four days previously with the fluid aspirated from the eye of horse 716, about three weeks after the onset of the fourth typical attack of periodic ophthalmia, was injected into the anterior chamber of the left eye. Smears and cultures of the material injected were negative. Two-tenths of a cubic centimeter of the water of condensation of a Loeffler's blood-serum slant, inoculated three days previously with the fluid aspirated from the acutely inflamed eye of horse 717, five days after the onset of a second recurrence, was injected into the anterior chamber of the right eye. Smears and cultures of this material revealed the typical bacillus.

May 5, the right eye was closed and the lids greatly swollen. There was marked lacrimation and discharge of yellowish pus. Circumcorneal congestion and edema of the cornea were marked and there was moderate clouding of the fluid in the anterior chamber. The left eye appeared normal.

May 29, the left eye was normal. Swelling of the lids, photophobia, lacrimation and discharge of pus from the right eye were marked. There was marked turbidity of the fluid in the lower half of the anterior chamber.

May 31, the left eye appeared normal. The inflammation of the right eye was less marked. There was a fibrinous exudate in the lower half of the anterior chamber. The eye was anesthetized with 2 per cent butyn solution and 2 cc of slightly turbid straw-colored fluid withdrawn with sterile precautions. On standing, a fibrinous coagulum formed.

June 2, the left eye appeared normal. Photophobia, swelling of the lids and lacrimation of the right eye were moderate and there was a thick, cloudy, fibrinous film in the lower half of the anterior chamber. Cultures from the fluid aspirated May 31 yielded Gram-negative bacilli.

June 12, the right eye was much improved, only slight lacrimation being present. The fluid in the upper half of the anterior chamber was clear; that in the lower half was filled with a cloudy fibrinous exudate. The left eye was normal.

June 16, the condition of the right eye remained about the same. Swabbings were taken from both eyes.

June 22, the right eye was improving slowly. Cultures from both eyes taken June 16 proved negative.

June 28, the inflammatory reaction of the right eye was worse. Photophobia, lacrimation and circumcorneal congestion were marked. The fluid of the anterior chamber was turbid. The lids were swollen and the horse was unusually irritable and nervous. The left eye was normal. Swabbings were taken.

July 1, the condition of the eyes was unchanged. Cultures of the swabbings of the left eye, made June 28, were negative; those of the right eye yielded large numbers of the typical bacillus.

July 6, the condition of the right eye was about the same, although the vision showed more impairment than would result from the clouding in the anterior chamber. Congestion, lacrimation and photophobia of the left eye were slight. Swabbings were taken.

July 9, the right eye was improved and the fibrinous exudate in the lower half of the cornea was nearly gone. Cultures of swabbings from the left eye were negative; from the right eye, positive.

July 14, the right eye was worse. Lacrimation, swelling of the lids, and circumcorneal congestion were marked. The fluid in the anterior chamber was cloudy; the fibrinous exudate in the lower half was larger and the fluid more cloudy. Vision was absent in the right eye. The left eye appeared normal, but the animal apparently had difficulty in distinguishing objects, tending to strike its head against them. The eyes were anesthetized and 2 cc of moderately turbid lemon-yellow fluid withdrawn from the right eye and 1.5 cc of clear fluid from the left.

July 15, the condition of the eyes appeared about as on the previous day, although the fluid in the right eye was slightly more turbid. The eyes were anesthetized and fluid again withdrawn.

July 16, the condition of the eyes remained about the same.

July 21, the condition of the eyes appeared about as before. Cultures of the fluids obtained July 14 and of the left eye obtained July 15 were sterile. There were a few colonies of the characteristic bacillus and Gram-positive diplococcus in the soft alfalfa agar and alfalfa-agar slant. From cultures of the fluid from the right eye obtained July 15, a pure culture of the bacillus was obtained in the water of condensation of a bean-infusion-agar slant.

July 30, the animal was blind in the right eye. Lacrimation, swelling of the lids and congestion continued. The fluid in the anterior chamber was only slightly cloudy. The left eye-ball seemed prominent. The animal kept its lids partly closed and had difficulty in distinguishing objects. The fluids in the anterior chamber, the cornea and the lens were clear.

August 1, the eyes were improved.

August 6, the right eye showed less reaction and the fluid was less cloudy, but the animal was still unable to see with this eye. The left eye appeared normal.

August 15, the condition of the eyes remained as on August 6.

August 25, the inflammation of the right eye had become worse. The lacrimation, photophobia and swelling and congestion of the lids were more marked, and the fluid in the anterior chamber was more turbid. Vision was absent. There were also undoubted swelling of the lids and lacrimation of the left eye. The animal rubbed its left eye repeatedly against objects. The lens was cloudy, but the fluid in the anterior chamber was clear; vision continued impaired.

Agglutination Experiments

The blood from affected and normal horses and from immunized and normal rabbits was withdrawn from the jugular vein and allowed to clot in test tubes, and twenty-four hours later the serum was decanted after centrifugation. In most instances 0.2 per cent cresol was added as a preservative.

In a series of preliminary tests it was found that the agglutinability of different strains and the agglutinating power of different serums varied considerably, thus necessitating the use of graded dilutions of the serum. The most suitable dilutions were found to be 1:10, 1:20, 1:50 and 1:100, normal serum only rarely agglutinating strains at or above dilutions of 1:10 and serums from

affected animals above dilutions of 1:100. Either the dilutions of the serum were made in sodium chlorid solution and 0.2 cc of each added to an equal amount of bacterial suspension in test-tubes 0.8 by 7 cm. in size, or the undiluted serums were added with a fine capillary pipette in requisite amounts (1, 2, 5 and 10 drops) to 0.5 cc of the bacterial suspensions. The organisms were grown in broth, on meat-infusion agar, or preferably bean-infusion or alfalfa-infusion agar. The 24-hour broth cultures may be used directly, although more consistent results were obtained by centrifuging and suspending the organism in sodium chlorid solution. The growth from agar slants was suspended in sodium chlorid solution and used immediately, or more often the bacteria were centrifuged and preserved for later agglutination tests in dense suspensions of glycerin (two parts) and saturated sodium chlorid solution (one part) as were those from broth cultures. The density of the suspensions, after the addition of the serum most suitable, was about twice that of the broth culture. The mixtures were incubated at 37°C. for one and one-half to two hours, when a preliminary reading was taken. They were then kept in the ice-chest over night and a second reading recorded. A suspension in sodium chlorid solution was used as a control. The degree of agglutination was graded on the basis of 0 to 4. The experiments were performed as far as possible with serums obtained on the same day from affected and normal animals (preferably from the same herd or from the team-mate) and were usually repeated once or oftener. A fairly large number of strains were used with each of the serums tested and the source of the strain was varied both as to location and material from which it was isolated.

The results summarized in tables III, IV and V are representative of a large number of additional experiments. The serums used in table III were obtained July 22 and the experiments performed July 25. The ocular symptoms in the affected animals were active at the time; all had had severe previous attacks, but each subsequent attack was milder and of shorter duration, coincidental with a series of weekly injections of a filtrate from an exhaust culture of the bacillus. Strains 1 and 3 were isolated from fluid and emulsions of exudate from the anterior chamber of spontaneously affected eyes. Strain 2 was atypical and was isolated from the eye of a horse injected weeks previously with a culture of the fluid from the anterior chamber. Strains 4 and 5 were from oats and ground oats fed to ten animals in Wis-

consin, one of which had contracted the disease within the previous month. Strains 6 and 7 were from the conjunctival sacs of two affected horses, one in New York, the other in Minnesota. Strain 8, isolated from ground oats, was atypical, resembling *Bacillus pyocyaneus*. Strain 9 was a streptococcus from a case of iritis in man; strains 10 and 11 were diplococci believed to be mutations isolated from the emulsion of an eye of a horse

TABLE III—*The agglutinating power* of the serum obtained from affected and vaccinated horses during an outbreak of periodic ophthalmia in New York*

SERUM FROM HORSES	DILUTIONS	BACTERIAL SUSPENSIONS (STRAINS)												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Linda (Affected 5 months)	1:10	4	0	4	4	3	3	3	2	4	3	4	3	0
	1:20	4	0	3	2	3	3	3	1	4	2	4	2	0
	1:50	4	0	2	0	2	2	3	0	3	2	2	0	0
	1:100	2	0	0	0	1	0	2	0	2	2	1	0	0
Whalebone (Affected 4 months)	1:10	4	0	2	2	4	3	3	2	4	3	3	2	0
	1:20	3	0	1	0	4	3	3	1	3	3	2	0	0
	1:50	3	0	0	0	2	0	0	0	2	2	0	0	0
	1:100	0	0	0	0	1	0	0	0	2	0	0	0	0
Blue Bird (Affected 5 months)	1:10	4	0	3	3	3	3	3	2	3	2	4	3	0
	1:20	3	0	2	2	3	2	3	1	3	2	3	1	0
	1:50	3	0	1	2	2	2	2	0	2	0	1	0	0
	1:100	3	0	0	1	0	0	0	0	2	0	0	0	0
Squire (Normal)	1:10	3	0	2	0	2	3	2	2	3	2	0	1	0
	1:20	2	0	0	0	1	2	0	1	2	0	0	0	0
	1:50	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:100	0	0	0	0	0	0	0	0	0	0	0	0	0
Desert Gold (Normal)	1:10	0	0	2	0	2	3	2	3	2	2	3	2	0
	1:20	0	0	1	0	1	1	2	2	2	0	3	1	0
	1:50	0	0	0	0	0	0	0	0	2	0	1	0	0
	1:100	0	0	0	0	0	0	0	0	0	0	0	0	0
Red Fox (Normal)	1:10	2	0	2	0	2	2	2	2	2	2	3	2	0
	1:20	0	0	1	0	1	0	2	2	2	1	2	0	0
	1:50	0	0	0	0	0	0	0	0	2	0	1	0	0
	1:100	0	0	0	0	0	0	0	0	1	0	0	0	0
Control (Sodium chlorid solution)		0	0	0	0	0	0	0	0	0	0	0	0	0

*Graded from 0 to 4

injected with the bacillus in the fourth animal passage. Strain 12 was a diplococcus cultured, together with the bacillus from an acutely affected eye in the spontaneous disease in a horse, and strain 13 with a staphylococcus isolated from the brain of a monkey.

Agglutination was more marked or occurred in higher dilution or both, with the serum of the affected and vaccinated animals

than with the control normal serums. This was true in the case of all of the typical strains of the bacilli (1, 3, 4, 5, 6 and 7), irrespective of their source, of the strain (9) of streptococcus from a case of iritis in man and of the three strains of diplococci

TABLE IV—*The agglutinating power* of the serum of affected horses before and after absorption with the characteristic bacillus*

SERUM FROM HORSES		DILUTIONS	BACTERIAL SUSPENSIONS (STRAINS)												
			1	2	3	4	5	6	7	8	9	10	11	12	13
Affected (New York)	Linda (Affected 5 months)	1:10	3	3	3	3	3	3	3	4	4	4	1	0	2
		1:20	2	3	2	2	2	2	2	4	4	4	0	0	0
		1:50	1	1	2	2	2	2	0	3	4	4	0	0	0
		1:100	1	1	1	2	1	0	0	2	4	3	0	0	0
	Linda (Absorbed)	1:10	0	2	0	1	2	2	3	3	3	4	0	0	2
		1:20	0	1	0	1	2	1	2	2	3	4	0	0	1
		1:50	0	0	0	0	0	0	0	2	3	4	0	0	1
		1:100	0	0	0	0	0	0	0	2	3	3	0	0	0
	Blue Bird (Affected 5 months)	1:10	2	3	2	2	3	3	3	4	4	4	1	0	1
		1:20	2	2	1	2	2	2	2	3	3	3	0	0	0
		1:50	2	2	0	2	1	2	0	3	3	3	0	0	0
		1:100	1	1	0	1	0	0	0	3	3	2	0	0	0
Normal (New York)	Squire	1:10	0	0	0	0	0	0	1	2	3	3	0	0	2
		1:20	0	0	0	0	0	0	0	2	2	0	0	0	0
		1:50	0	0	0	0	0	0	0	0	1	0	0	0	0
		1:100	0	0	0	0	0	0	0	0	0	0	0	0	0
	Desert Gold	1:10	0	1	0	0	0	0	2	2	3	3	0	0	2
		1:20	0	0	0	0	0	0	0	2	3	2	0	0	0
		1:50	0	0	0	0	0	0	0	0	1	2	0	0	0
		1:100	0	0	0	0	0	0	0	0	0	0	0	0	0
Affected (Wisconsin)	Polly (Affected 1 month)	1:10	2	3	3	3	3	3	2	4	4	4	1	0	2
		1:20	1	2	2	3	2	2	2	3	3	3	0	0	1
		1:50	1	1	1	2	1	0	1	3	3	3	0	0	0
		1:100	1	0	0	1	0	0	2	3	3	2	0	0	0
	Polly (Absorbed)	1:10	0	2	0	2	1	1	1	3	4	3	0	0	2
		1:20	0	0	0	1	0	0	1	3	3	3	0	0	1
		1:50	0	0	0	0	0	0	0	2	3	2	0	0	0
		1:100	0	0	0	0	0	0	0	0	3	0	0	0	0
Normal (Wisconsin)	Molly	1:10	0	0	0	0	1	1	0	0	3	2	0	0	2
		1:20	0	0	0	0	0	0	0	2	2	1	0	0	0
		1:50	0	0	0	0	0	0	0	0	2	0	0	0	0
		1:100	0	0	0	0	0	0	0	0	2	0	0	0	0
Control (Sodium chlorid solution)			0	0	0	0	0	0	0	0	0	0	0	0	0

*Graded from 0 to 4

(10, 11 and 12). This was not true of the atypical strains of bacilli in suspensions 2 and 8, nor of the control staphylococcus (strain 13). The serum of these affected animals, together with

that of six others affected, obtained May 21, was also found to have greater agglutinating power than normal controls but this was not so marked as is shown in table III.

The experiment recorded in table IV was performed August 2. The serums of the horses in New York were obtained July 22; those in Wisconsin July 10. Absorption of agglutinins was tested by adding enough of the dense bacterial suspension (in glycerin and sodium chlorid solution) of the strain isolated from the emulsion of the iris of horse 702 to the serum diluted 1:10 to bring the mixture to twice the density of a broth culture. The suspension was incubated for one and one-half hours, placed in the ice-chest over night and clumped bacteria removed by centrifugation. The procedure was repeated once the following day. The bacterial suspensions used as antigens were prepared from the following strains: Strains 1 to 8 were typical strains of the bacillus. Of these, strain 1 was from the eye of horse 702, strains 2 and 3 were from oats and pea hay in New York, strain 4 was from oats in Wisconsin, and strains 5 to 8 were from water, bran, hay, and oats which were being fed to horses on a farm in New York during the time that two animals contracted the disease. Strain 9 was a diplococcus isolated from the eye of a horse injected with the bacillus in the fourth animal passage. Strain 10 was a staphylococcus from the internal structure of the atrophic eye of a horse that had gone blind, over which the serum had agglutinating power greater than that of normal horse serum. Strain 13 was a Gram-positive bacillus from the same horse but was not agglutinated by its serum. Strain 11 was a streptococcus isolated from water. Strain 12 was a staphylococcus isolated from the brain of a monkey.

It will be noted that with the serums of affected animals agglutination was greater than with normal serums over all strains of the bacillus, irrespective of their source, and that the agglutinating power was greatly reduced or entirely removed in all of these strains by absorption with one strain isolated from the iris of the acutely affected eye of horse 702. Antigens 9 and 10, consisting of suspensions of Gram-positive cocci isolated from the eyes of affected horses, were agglutinated markedly by the unabsorbed serums, and almost as much by the absorbed serums, of affected animals. Agglutination of the control strains 11, 12 and 13 by the serum of affected animals was no higher than the agglutination by normal serums.

The serums of the horses used in the experiment recorded in table V were obtained May 20, and the experiment was performed May 31. None of the animals had been vaccinated. The bacterial suspensions 1 to 6 consisted of strains of the bacillus morphologically and culturally typical. Of these, antigen 1 was from the conjunctival sac, antigen 2 from the iris of affected horses in New York, antigen 3 from a mixture of strains

TABLE V—*The agglutinating power* of the serum of affected horses in Maryland over strains of the bacillus isolated in different outbreaks*

SERUM FROM HORSES	DILUTIONS	BACTERIAL SUSPENSIONS (STRAIN)									
		1	2	3	4	5	6	7	8	9	10
Flip Tip (Affected one year)	1:10	3	3	3	0	3	2	0	4	0	0
	1:20	3	2	2	0	3	2	0	2	0	0
	1:50	2	1	2	0	2	1	0	1	0	0
	1:100	0	0	2	0	1	0	0	0	0	0
Kathleen's Sister (Affected one year)	1:10	3	3	3	1	4	3	2	4	0	0
	1:20	3	2	3	0	3	3	0	3	0	0
	1:50	3	1	2	0	3	2	0	2	0	0
	1:100	2	0	2	0	2	1	0	0	0	0
Kathleen (Affected one year)	1:10	4	3	3	0	4	2	2	4	0	0
	1:20	3	3	3	0	3	3	1	4	0	0
	1:50	3	2	3	0	3	2	0	3	0	0
	1:100	2	0	2	0	2	1	0	0	0	0
Tokay (Affected one and a half years)	1:10	4	4	3	0	4	2	2	4	0	0
	1:20	3	3	3	0	4	3	1	4	0	0
	1:50	3	2	3	0	3	3	0	2	0	0
	1:100	2	1	2	0	2	1	0	0	0	0
Muskat (Normal)	1:10	2	0	2	0	2	2	0	4	0	0
	1:20	0	0	2	0	2	2	0	2	0	0
	1:50	0	0	0	0	0	0	0	0	0	0
	1:100	0	0	0	0	0	0	0	0	0	0
Acontius (Normal)	1:10	2	0	2	0	2	2	0	4	0	0
	1:20	0	0	2	0	0	3	0	4	0	0
	1:50	0	0	0	0	0	2	0	2	0	0
	1:100	0	0	0	0	0	0	0	0	0	0
Control (Sodium chlorid solution)		0	0	0	0	0	0	0	0	0	0

*Graded from 0 to 4

from the conjunctival sacs of horses also from New York, antigen 4 from the eye of horse 708 injected with the exudate of horse 702, and antigen 5 from alfalfa hay fed, when the epizoötic began, to the horses whose serums were used. Antigens 6 and 7 represent Gram-positive diplococci; the former was isolated from the fluid of an affected eye, the latter from the

conjunctival sac of another horse in New York. The strain used in antigen 8 was a Gram-negative diplococcus isolated from oats. Antigen 9 was a colon bacillus isolated from water, and antigen 10 was a staphylococcus from an extraneous source. Agglutination of four of the five strains of the bacillus was consistently higher in the serum of affected animals than in the normal control serums. This was especially marked in the case of the strain isolated from alfalfa hay fed to these animals when they manifested their first attack. Strain 4, which was not agglutinated, resisted agglutination by all other serums of horses affected spontaneously, as well as by those from horses in which the disease was induced experimentally, and by that from a horse which was being immunized with the bacillus. The diplococci in antigens 6, 7 and 8 were agglutinated in the serums of affected horses scarcely more than in the serums of normal horses, while the colon bacillus (antigen 9) and the staphylococcus were not agglutinated at all.

Agglutination experiments were performed with the serums of twenty-one affected horses, representing four outbreaks, in which there was no reason to doubt that they were having or had had attacks of periodic ophthalmia. Of these horses, thirteen were manifesting active ocular symptoms which had been present for two weeks or longer at the time the blood was drawn. Their serums agglutinated different strains of the bacillus in higher dilution and more markedly than did the respective control normal serums. In the case of one horse, mild symptoms of the first attack had been present for only one week. The serum behaved as did the serum of normal horses. This was true also in the case of one horse that had recovered from a mild attack four months previously. Three had recovered within a month from several previous severe attacks. Their serums agglutinated the bacillus specifically. The serums of three horses that had gone blind in one or both eyes years before, and in which ocular symptoms were dormant, also behaved toward the bacillus as did normal serum. The serums of twenty-nine normal horses that had never had the disease, of which all but three were from the four affected herds, were used as controls. Also, the agglutinating power of the serum of six horses in which the disease had been induced by intraocular injection of the bacillus was tested immediately before inoculation and in respectively seven, seven, nine, thirty-three, thirty-eight and forty-four days after. The ocular reaction in the first three was especially pro-

nounced. The agglutinating power of the serum in each of these animals was greater after inoculation than before and was roughly proportional to the degree and duration of the experimental disease.

The serums from six affected animals were obtained for agglutination tests at intervals during the course of the disease. In all of these, a definite increase in agglutinating power occurred as the disease progressed. Most of the different strains of the bacillus, irrespective of the site or material from which they

TABLE VI—*The agglutinating power* of the serums of immunized rabbits*

ANIMAL	IMMUNIZING ANTIGENS	DILUTIONS	BACTERIAL SUSPENSIONS (STRAINS)									
			1	2	3	4	5	6	7	8	9	10
R 1992	701 autoclaved	1:10	2	2	0	2	1	0	0	0	0	0
		1:20	0	2	0	2	1	0	0	0	0	0
		1:50	0	0	0	2	0	0	0	0	0	0
		1:100	0	0	0	0	0	0	0	0	0	0
R 1993	701 autoclaved	1:10	2	2	2	2	0	0	0	0	0	0
		1:20	2	1	1	2	0	0	0	0	0	0
		1:50	2	0	0	1	0	0	0	0	0	0
		1:100	1	0	0	0	0	0	0	0	0	0
R 2017	701	1:10	3	3	2	2	1	2	0	0	0	0
		1:20	3	2	2	2	1	0	0	0	0	0
		1:50	2	2	1	2	0	0	0	0	0	0
		1:100	2	0	0	1	0	0	0	0	0	0
R 2013	Control Glucose broth	1:10	0	0	0	0	0	0	0	0	0	0
		1:20	0	0	0	0	0	0	0	0	0	0
		1:50	0	0	0	0	0	0	0	0	0	0
		1:100	0	0	0	0	0	0	0	0	0	0
R 2024	Control Glucose broth	1:10	0	0	0	0	0	0	0	0	0	0
		1:20	0	0	0	0	0	0	0	0	0	0
		1:50	0	0	0	0	0	0	0	0	0	0
		1:100	0	0	0	0	0	0	0	0	0	0
Control (Sodium chlorid solution)			0	0	0	0	0	0	0	0	0	0

*Graded from 0 to 4

were isolated, were immunologically alike. They were agglutinated by different serums of nearly all affected animals, and absorption with one strain removed agglutinins for nearly all strains tested. The serum of one horse in Wisconsin, whose right and left eyes had become affected respectively a month and two weeks before, and which manifested marked swelling of the lids, lacrimation, photophobia, and congestion continuously until the serum was obtained, agglutinated specifically

all but three of twenty-eight different strains of the bacillus. The strains were isolated from eyes of horses or from feeds in different outbreaks occurring in four states.

The rabbits from which serum was obtained for the agglutination experiments recorded in table VI, were injected with comparable amounts of filtrate and of the corresponding uninoculated broth. The filtrate (701), prepared from a mixture of exhaust cultures of five typical strains of the bacillus, was proved sterile and preserved with 0.5 per cent phenol. It was extremely toxic and the injections, begun with 0.4 cc, were gradually increased during five weeks to 3 cc, injections being given daily on three days each week. After autoclaving for one hour the toxicity was sufficiently reduced so that immunizations were begun with 2 cc and gradually increased to 3 cc. The blood was withdrawn twenty-two days after the last injection.

The experiment recorded in table VI is representative of others made with these serums and the serums of other rabbits similarly immunized. The bacterial suspensions 1 to 6 were made from typical strains of the bacillus; 7 and 8 from Gram-positive diplococci; 9 from a Gram-positive diplococcus and 10 from *Staphylococcus albus*, both isolated from the conjunctival sacs of affected horses. Agglutination in varying degree occurred in all but one of the bacillus suspensions with the immune serums but not with the control serums. The sixth strain was agglutinated only by the serum of the rabbit immunized with the unautoclaved filtrate. None of the control strains was agglutinated. Owing to the high resistance of the toxin to heat, it was thought that animals might be immunized by the alimentary route. Accordingly, a series were given the filtrates and dead cultures into the stomach through urethral catheters. At first, 5 cc was given three times weekly. This amount was gradually increased to 10 cc. Control rabbits received like amounts of the uninoculated broth. The agglutinating power of the serums was tested after immunization had been continued for from four to eight weeks. Only slight evidence of increase in agglutinin content was obtained in rabbits that received the unautoclaved filtrate, and none at all in those receiving the autoclaved filtrate.

Immunization Experiments

As already shown, agglutinins developed in the serum of rabbits injected intravenously with filtrates of old cultures of the bacillus or with the killed cultures, but in rabbits fed with

TABLE VII—*General and ocular immunity of rabbits to living cultures of the bacillus following repeated injections of filtrates and killed cultures*

Immunization						Early Effects on			Late Effects on Eyes (Grade)					
Animal	Antigen	Route	Duration (Days)	Number of Injections	Days Since Last Injection	General Condition	Eyes (Grade)	Right or Left	6–21	6–22	6–23	6–24	6–27	7–1
R 2017	Filtrate 701	Intravenous	29	14	22	Slight	1	L R	2 1	2 0	2 0	1 0	0 0	0 0
R 1922	Filtrate 701 (Autoclaved)	Intravenous	38	15	22	Slight	1	L R	1 0	2 0	3 0	2 0	1 0	0 0
R 2024	Glucose broth (Control)	Intravenous	24	12	22	Marked	4	L R	4 3	4 3	4 3	4 1	4 0	2 0
R 2120	Uninjected (Control)					Death in two hours	?	L R						
R 2069	Filtrate 701	Into stomach	9	9	19	None	1	L R	2 0	2 0	2 0	2 0	1 0	0 0
R 2039	Filtrate 701 (Autoclaved)	Into stomach	21	22	19	None	1	L R	2 0	2 0	2 0	1 0	0 0	0 0
R 2058	Dead culture 698	Into stomach	17	15	19	None	1	L R	1 0	2 0	2 0	2 0	2 0	0 0
R 2059	Glucose broth (Control)	Into stomach	15	15	19	Marked	3	L R	3 2	3 2	3 1	2 0	4 0	2 0
R 2117	Uninjected (Control)					Death in two hours	?	L R						

the filtrate or dead culture it did not. It remained to be determined whether a general, an ocular or a double immunity to the effects of cultures and filtrates could be induced by these methods. Attempts to produce immunity have been made in a large number of rabbits but, owing to the high toxicity of the filtrates and cultures, a large proportion of the rabbits succumbed during the early period of injections. However, by gauging the dose properly, as already detailed, it has been possible, in a series of rabbits, to continue injections long enough and in sufficient dosage to determine the degree and extent of the immunity, whether general, ocular, or both.

The general or ocular immunity of rabbits that were injected once intravenously, or intraocularly, with living cultures was investigated at different intervals following inoculation. The results summarized in table VII are representative of many others and will suffice to illustrate the observations made in this field. The immunizing injections were given daily, for three days each week, into the marginal vein of the ear or into the stomach through a urethral catheter. The animals which weighed from 1400 to 2000 gm. lost little or no weight and appeared well, and their eyes remained normal during the period of immunization. The test injection was made June 20 and consisted of a 24-hour broth culture of the bacillus isolated from the eye of horse 702. Two-tenths of a cubic centimeter of the undiluted culture for each 100 gm. of body weight was injected intravenously, and 0.05 cc of the culture diluted 1:10 with sodium chlorid solution into the anterior chamber of the left eye under ether anesthesia. The degree of reaction in the eyes was recorded on a basis of 0 to 4. It will be seen that the autoclaved and the unautoclaved filtrate (701) conferred a high degree of general and ocular immunity, both when given by the intravenous (rabbits 2017 and 1992) and by the gastro-intestinal route (rabbits 2069 and 2039). The general immunity was manifested by the slight constitutional symptoms, as compared with those of the controls, following intravenous injection of the test culture, the ocular immunity by the slightness of the local reaction in the right eye following intravenous injection and in the left eye following intraocular injection of the diluted culture, as compared with that in the controls. The dead culture with which rabbit 2058 was immunized by the gastro-intestinal route also conferred immunity (figures 11, 12 and 13). Results similar to these were obtained in two other series

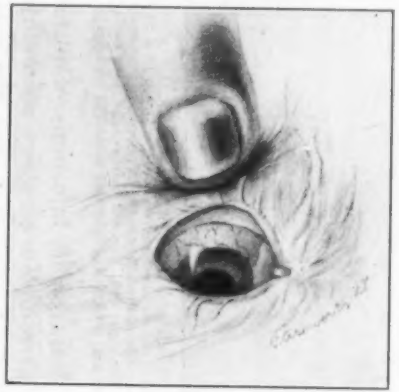

FIG. 11

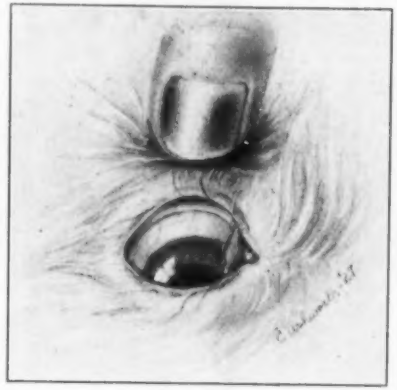

FIG. 12

FIG. 13

FIGS. 11, 12 and 13. Drawings of eyes of rabbits 2017, 2058 and 2024 (table VII), injected five hours before with a 24-hour broth culture of the bacillus isolated from the eye of horse 702. Note the slight reactions of the two previously immunized (figs. 11 and 12) and the marked reaction of the normal control (fig. 13).

of immunized rabbits. One or two intravenous or intraocular injections, or both, of filtrates or dead bacteria, as well as living cultures, do not suffice to call forth measurable immunity. Intraocular injections of the bacillus appear to sensitize the

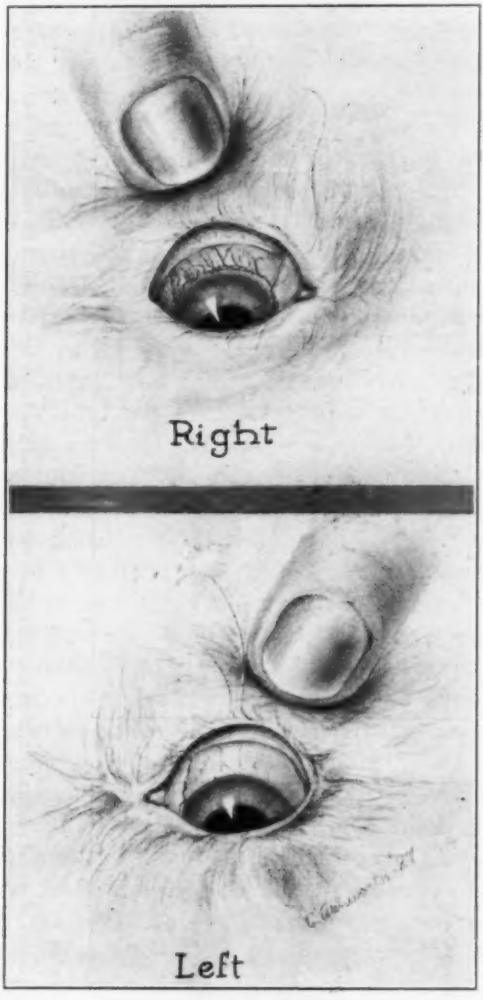

FIG. 14. Drawings of eyes of a rabbit injected five hours before with a 24-hour broth culture of the bacillus. Note the moderate reaction in the left previously-uninjected eye and the marked reaction in the right eye, injected thirty-eight days before with the bacillus and which had returned nearly to normal.

eye for a time to intravenous injections of filtrates and cultures (fig. 14) but, as complete recovery occurs, the previously injected eye becomes more resistant than the normal eye.

Considering the nature of the disease and the fact that the bacillus produces a potent toxin, it was thought early in the work that active immunization with filtrates and killed cultures, once a week, might prevent recurrences and perhaps aid in the recovery of actively affected eyes. Immunization has also been used prophylactically by means of several intracutaneous injections and one subcutaneous injection, to prevent the spread of the disease in infected herds. It has been given to fifty-two normal horses, from four affected farms, representing four outbreaks. In no instance has the disease developed subsequent to injections, whereas of about an equal number of controls in the same herds, two are known to have contracted the disease. A highly toxic filtrate (701) and killed cultures have been used as active immunizing agents in twenty-eight horses that had had one or more attacks before immunization was begun. The results in these are encouraging although far from conclusive. It has seemingly prevented recurrences in those animals that have had the disease only a short time or in a mild form, prolonged the interim between attacks and reduced the severity of subsequent attacks in animals whose eyes were badly affected, and in some instances seems to hasten recovery from actual attacks. This was seemingly striking in several cases. In no instance has the use of the vaccine made the ocular symptoms worse. A more detailed and extensive study will be reported later.

Two horses are being immunized with increasing amounts of the filtrates and dead cultures in the hope of developing an antitoxic serum. Horse 44 has been given three subcutaneous injections each week since April 4, beginning with 5 cc and increasing to 180 cc at the last injection. Local reactions are marked and the agglutinating power of the serum has steadily increased. The serum obtained from a test bleeding (July 31) has been found to possess considerable neutralizing power. The experiment recorded in table VIII was performed August 2. The strain of the bacillus injected into the rabbit was not used in preparation of the filtrate with which the horse is being immunized. The 24-hour culture and filtrate were treated with equal amounts of sodium chlorid solution, with normal horse serum and with the immune horse-serum. These various mixtures were incubated for two hours at 37° C. and kept in the ice-chest over night. Control plate-cultures at the time of injection showed that there was an approximately equal number of viable bacilli in the different mixtures containing the culture.

Two-tenths of a cubic centimeter of the mixtures containing the living culture (736) and twice this amount of the mixtures containing filtrate (701) to each 100 gm. of weight were injected intravenously. The rabbits weighed from 1400 to 2100 gm. The degree of general and ocular symptoms are recorded on the scale of 0 to 4. It will be seen that the neutralizing power of the normal horse-serum was considerable and of the immune serum marked, as regards both the general and the ocular reaction of the toxin in the filtrate. The results given in table VIII have been repeated in another similar experiment.

TABLE VIII—*Neutralizing power of the serum of a horse immunized with the filtrate*

ANIMAL	MATERIAL INJECTED	GENERAL REACTION BY HOURS (GRADE)					OCULAR REACTION BY HOURS (GRADE)				
		1	2	3	24	28	1	2	3	24	48
R 2176	Culture and sodium chlorid solution	0	1	2	1	0	0	3	2	1	0
R 2179	Culture and sodium chlorid solution	1 Death					1				
R 2177	Culture and normal serum	0	1	1	0	0	0	2	1	1	0
R 2180	Culture and normal serum	0	1	1	0	0	1	3	2	1	0
R 2178	Culture and immune serum	0	1	0	0	0	0	1	1	0	0
R 2181	Culture and immune serum	0	1	0	0	0	0	1	1	0	0
R 2182	Filtrate and sodium chlorid solution	0	3	3	0	0	0	3	2	1	0
R 2183	Filtrate and normal serum	0	1	0	0	0	0	1	2	0	0
R 2184	Filtrate and immune serum	0	0	0	0	0	0	0	1	0	0

SUMMARY AND CONCLUSIONS

The consistent isolation of a peculiar bacillus, often in conjunction with a diplococcus, from the fluid or exudate in the anterior chamber in the early stages of attacks of periodic ophthalmia, and somewhat later from emulsions of affected tissues, is reported. The bacillus has been isolated with considerable regularity from the conjunctival sac of acutely affected eyes, less commonly from those chronically affected, more rarely from normal horses of herds in which the disease existed and least often from normal horses of herds free from the disease.

It has been obtained consistently, often in large numbers, from suspected feeds such as hay and oats, and less often from the water supply on farms where the disease existed and far less commonly from farms where the disease had not occurred. The bacillus and the toxin which it produces have affinity for the eye when injected intravenously. A condition closely resembling the acute stages of the disease clinically and histologically has been reproduced by intraocular inoculation of material from within acutely affected eyes proved to contain the organism, of dilutions of pure cultures of the organism as isolated and after many subcultures, and during four successive passages through animals. Control inoculations of fluid from normal eyes, of sterile broth, and of diluted cultures of other bacteria of low general virulence and manifesting no affinity for the eye have little or no effect. The disease induced with pure cultures in two horses, now some months since inoculation, is running a course typical of the spontaneous disease. Several exacerbations and remissions have occurred. The eyesight has disappeared, the intraocular pressure in the anterior chamber is diminished, the eyeballs and periocular tissues are showing noticeable atrophy, and in one the opposite eye has become involved. The bacillus has been reisolated from the fluids aspirated during acute attacks. The serum of both has manifested increased agglutinating power.

The serum of horses having active symptoms agglutinates the bacillus and some strains of the associated diplococcus (but none of the control strains) more markedly and in higher dilution than does the serum of normal horses. The serum of horses in which the disease is induced experimentally by intraocular injection of pure cultures acquires specific agglutinating power over the bacillus.

The serums of rabbits injected intravenously with filtrates and dead cultures of the bacillus develop specific agglutinating power. General and ocular immunity, both to intravenous and to intraocular injection of cultures and filtrates of the bacillus, have been induced in rabbits by repeated intravenous injection and by repeated introduction into the stomach of filtrates or killed cultures of the bacillus.

The intracutaneous and subcutaneous injections of filtrates or killed bacterial suspensions in horses appear to be effective in preventing the disease in unaffected animals and in diminishing the number and severity of attacks in those already affected.

The serum of one horse that has been immunized for five months with increasing doses of a highly toxic filtrate has developed moderate neutralizing or antitoxic power, effective in the rabbit against both living cultures and sterile filtrates.

The various strains of the bacillus isolated, in widely separated outbreaks, from eyes of horses and from suspected feeds, are much alike morphologically and culturally, in their toxin-producing power, and in their behavior toward agglutinating serums of affected or artificially immunized animals. Absorption of agglutinins with one strain removes them for nearly all others.

The significance of the diplococcus often associated with the bacillus is not entirely clear. It appears to be a mutation, and since cultures injected intravenously in rabbits cause congestion of the eyes, and diluted cultures a condition in the eyes of horses simulating the disease, and since it is agglutinated by the serum of affected horses, it is at least not a harmless secondary invader or contamination.

The conclusion that the bacillus isolated has etiologic significance in periodic ophthalmia seems warranted, and the name *Flavobacterium ophthalmiae* would seem appropriate. The infection in the eye appears to be hematogenous, the portal of entry the alimentary tract, and the source of the organism various feeds or water.

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NEWS ITEMS

Calhoun County, Michigan, was placed under a quarantine for rabies, for a period of three months, about the middle of December.

Idaho has been making such rapid strides in tuberculosis eradication that approximately one-half of the 44 counties in the State were in line to be accredited by January 1.

THE RELATION BETWEEN THE MEDICAL AND VETERINARY PROFESSIONS WITH SPECIAL REFERENCE TO LABORATORY AND PUBLIC HEALTH WORK

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Permit me, in the first place, to express the deepest appreciation of the high honor conferred upon me last year by election to honorary membership in the American Veterinary Medical Association. It is difficult for me to understand why this was done, but I like to believe that it was in recognition of the little research work I have been able to do in the immunology and chemotherapy of some of the diseases of the lower animals and more especially because of my firm conviction of the advisability of bringing the medical and veterinary professions into closer contact and drawing upon your profession for members to take over some of the public health and laboratory work of human medicine.

My research work in immunology, vaccine and serum therapy, and more recently in chemotherapy, has brought me into unusual contact with veterinary medicne and so much of our knowledge of these subjects has been gained from studies on the lower animals that it is not strange that they were early and directly benefited by the practical application of newer knowledge in the diagnosis and treatment of some of their diseases.

Furthermore, I have been long and intimately in touch with the increasingly difficult problem of securing or training bacteriologists, pathologists and serologists for teaching, public health, hospital and private diagnostic laboratories throughout the United States. So few of our medical graduates have gone into laboratory medicine as a career and the demand for properly qualified workers has been so high that a very perplexing situation has arisen, partly solved at present by the training of laboratory technicians. Under the circumstances it is not strange that individuals with no medical training at all and with very little laboratory experience have been virtually placed in charge

*Address delivered at the banquet of the sixty-fourth annual meeting of the American Veterinary Medical Association, Philadelphia, Pa., September 14, 1927.

of hospital laboratories and have set up commercial diagnostic laboratories totally unfitted to shoulder the tremendous responsibilities involved.

Indeed the situation has become so bad that the Medical Society of the State of Pennsylvania appointed a committee some years ago, which is still in commission to suggest remedial measures, and the American Society of Clinical Pathologists was organized in part for the purpose of elevating the educational and financial status of clinical pathology and to limit its practice to properly qualified individuals in so far at least as the responsible positions were concerned. And during the past year or two our great national body, the American Medical Association, has stepped into the reorganization for the benefit and protection of both the medical profession and the laity.

But in truth we do not have a sufficient number of medical graduates to meet the demands. As a result many Ph. D. men and women and an even larger number with no degrees at all have entered the field, but I believe that our V. M. D. men are especially well qualified, because your training in the medical sciences of physiology, bacteriology, pathology, serology and chemistry has been and is essentially similar to that given in our medical schools. Furthermore, your training in milk and meat hygiene and food inspection has been much more thorough than ours and we recognize the veterinary profession as a whole as being experts in the epidemiology of tuberculosis. In other words your training has fitted you unusually well for public health work and likewise for careers in laboratory medicine after some additional training and experience has been gained with a few organisms capable of infecting human beings only and in the special diagnostic methods developed in the diagnosis and treatment of diseases of human beings. But I insist that you are peculiarly and particularly fitted for entering this field, not only by reason of your training in the fundamental medical sciences but likewise in medicine and surgery in general and in the public health aspects of many of the communicable diseases in particular.

In testimonial of these convictions I may state that when I needed a first-class assistant in bacteriology for the hospitals and teaching of the Graduate School of Medicine of the University of Pennsylvania, I secured Dr. Fred Boerner, formerly director of the Pennsylvania State Live Stock Sanitary Board Laboratory; and he has more than made good, having in a few years already risen to an assistant professorship in this subject

as well as having taken over supervision of all of the clinical pathological work. At no time have my students, all graduates from the best medical schools in the United States and some foreign countries, questioned his teaching or the propriety of having as a teacher a V. M. D. man. Nor have the staffs of the hospitals, composed of the leading medical and surgical experts of Philadelphia, ever questioned the propriety of my selection. And when I needed a good research bacteriologist for the Research Institute of Cutaneous Medicine I selected Dr. Malcolm J. Harkins, also a graduate in veterinary medicine, who has done excellently well in investigations upon the etiology of several diseases of human beings.

Furthermore the first steps have already been taken for the admission of properly qualified V. M. D. men to associate membership in the American Society of Clinical Pathologists, whose diploma is being widely accepted as a certificate of special efficiency in laboratory medicine. And I hope soon to see some plan developed for admission of graduates in veterinary medicine to associate membership in our county, state and national medical associations, as I am convinced that the work, aims and ideals of the two great professions are too closely interwoven and similar for them to go their ways separately. What a splendid plan it would be to have your men participate in our scientific programs and deliberations and we in yours! I am sure it could not help being of great assistance to us both in meeting the newer problems of today in public health and preventive medicine.

Yours is already a great work in the care of the lower animals, not only from the humanitarian standpoint of preventing suffering and disease among them, the importance and nobleness of which has been emphasized by the Supreme Being Himself, who said that not even a sparrow shall fall without His knowledge, but likewise in their conservation for the service and maintenance of mankind. But I believe the time has arrived when there should be a wider and deeper acknowledgment and appreciation of your special qualifications for public health and laboratory careers in human medicine. Indeed if the present plans for abolishing the degree of Doctor of Veterinary Medicine should meet with success because of its inadequacy, I would suggest the degree of Doctor of Medicine in Animal Diseases as a substitute for showing that you are first and foremost doctors of medicine, with special training in the diseases occurring among the lower animals, several of which are transmissible to human beings.

SPECIFIC INFECTIOUS CYSTITIS AND PYELONEPHRITIS OF COWS*

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It is the purpose of this communiction to recall attention to a well-defined clinical and pathological entity affecting the urinary tract of cows. It is true that several organisms attack the kidneys and bladder of cows, but the condition with which we have had to deal must be regarded as a specifflc infection, inasmuch as a single organism was cultivated from cases occurring over a period of years and on widely separated farms.

In Europe pyelonephritis was recognized by Guillebeau,[1] in 1888. Since that time it has been reported by many. Höflich[2] and Enderlen[3] both cultivated from affected kidneys a characteristic Gram-positive diphtheroid which Enderlen named *B. pyelonephritis boum.* Ernst[4] obtained material from abattoirs and cultivated a similar diphtheroid as well as *B. coli,* streptococci and other organisms. These diverse bacteriological findings and certain experimental evidence led him to question the etiological significance of the diphtheroid. However, more recent studies by the writers[5,6] have done much to define the position of this particular organism.

Joest[7] regards pyelonephritis as a specific infectious disease of cattle and calls attention to the fact that no other disease has a similar etiology and pathology.

Jones and Little[5] reported in detail their study of the condition in this country. Two cases of kidney infection with an unknown organism had been previously reported by Boyd.[8] Since our report he[9] has recorded a case from which diphtheroids were isolated. Udall[10] had previously cited two cases in the reports of the Ambulatory Clinic of the New York State Veterinary College.

Our first report included twenty cases from three herds. Since then the number has been doubled and material has come to us from many herds in New Jersey. We feel justified in the statement that the disease is a serious economic factor and that its early recognition is important, since, like tuberculosis, its spread

*Presented at the sixty-fourth annual meeting of the American Veterinary Medical Association, Philadelphia, Pa., September 13-16, 1927.

is insidious and even the apparent elimination of clinical cases fails to insure its complete elimination from the herd.

Characterization of Specific Cystitis and Pyelonephritis

On the whole the symptoms are not marked. The temperature is not increased, the appetite remains good. The gastro-intestinal tone is maintained. Perhaps the most striking symptom first noted is the frequent passage of relatively small quantities of brown urine, accompanied by considerable straining, usually followed by a few streams of bright blood. If the fore part of the urine is examined, it is usually dark brown and turbid, its reaction is alkaline, its specific gravity is increased, and it responds markedly to tests for albumin. Blood clots or particles of fibrin may be present. The centrifuged sample contains considerable sediment composed of red blood-cells, leucocytes, round cells, epithelial cells, crystals of triple phosphates, and masses of diphtheroid bacilli which readily stain by the ordinary methods and are Gram-positive. The last portion of the urine contains large quantities of blood. Later in the disease the urine contains less blood; its color may be normal but the turbidity and heavy sediment arouse suspicion.

The cow may continue to be a good producer for a long period or begin to lose flesh and suddenly go down. The time factor will depend on the location of the process and the resistance of the host to the spread of the infection from the bladder.

The lesions which we have encountered may be enumerated as follows: The bladder is first attacked. The mucosa varies from bright red to orange in color and is greatly swollen. The sac is contracted and the walls thickened. Frequently the mucosa is necrotic in places and replaced by a grayish-white membrane which, when forcibly removed, leaves a raw, bleeding surface. The walls of one or both ureters may be thickened, the mucosa reddened and the tube partially filled with purulent exudate.

The kidneys may or may not be involved. Frequently the lesions may be confined only to the pelvis which is dilated and filled with yellow, purulent exudate. In such instances there is no enlargement of the organ. If, however, the involvement is more diffuse, the kidney is often enlarged several times. The organ is mottled grayish-red. The capsule is adherent. The cortex is gray, tough, and constricted; the medulla grayish-red and tough. The pelvis and larger tubules are greatly dilated and filled with exudate. Microscopic examination shows the normal

cortical and medullary structures largely replaced by connective tissue and infiltrated with round cells and leucocytes.

It is not apparent from the textbooks that cystitis and pyelonephritis are related processes of the same disease. Ritzenthaler,[11] however, recognized the process as an ascending one; and with this view we concur, since our series of cases indicate that the bacterial agent first attacks the bladder mucosa and thence by way of the ureters reaches the kidney. Although it has not been possible by experimental means to establish this fact completely, nevertheless certain findings support this view. The organism grows readily in cow's urine. When freshly isolated broth cultures are introduced into the blood-stream in amounts of 5 to 10 cc, no kidney or bladder involvement results. If, however, small quantities of broth culture are introduced via the urethra into the bladder, a well-defined, persistent, slowly spreading cystitis results. The pathological findings in a series of cases substantiate the view that the infection is an ascending one. In the earlier cases the bladders alone were involved. In others, somewhat more advanced, we found in addition to bladder involvement one or both ureters affected. In the most advanced type the lesions of the bladder were more chronic in character, the ureters greatly thickened, and one or both kidneys involved.

Spread of the Disease

In a more or less general discussion of the problem certain remarks concerning the means of spread within the herd seem advisable. In an intensive investigation in one herd we examined the urine from all bulls but failed to find that the bull carries the organism in the urine or that the male suffers from this infection. We next attempted to show that the bull acts as a passive carrier, and in this connection we examined the urine from cows which had been bred to bulls that had first served infected cows. In no instance were we successful in doing so. Swabbing the vagina with culture likewise failed to transmit the disease. If, however, we placed normal cows adjacent to those infected so that the clinical cases were groomed and brushed before the normal cows, transmission resulted in two instances.

Several European workers have intimated that kidney infection may follow metritis or other genital infection. This is probably true when pyogenic organisms gain access to the blood-stream and localize within the cortex of the kidney. This, however, is not true in the disease which we studied. Our statistics

show that the condition is independent of genital infection and may occur at any time throughout the cow's life. Doubtless pregnancy, through the pressure of the fetus, may unfavorably influence the course of the malady.

Certain bacteriological investigations support the contention that the organism is a parasite of the urinary tract. We have examined the normal vaginal secretions and the exudates from metritis and failed to find the pyelonephritis bacillus. The urine from normal cows and bulls may contain diphtheroids but in no instance can it be said that types identical with the pyelonephritis bacillus were obtained. Thus far, then, it seems true that the only locus of the organism is the urinary tract of the infected cow.

Prognosis and Suggestions of Therapeutic Measures

It is obvious that involvement of the kidney affords a grave prognosis. Bladder infection, however, is less dangerous to the life of the animal. In many instances severe involvement of the bladder has failed to produce general symptoms, the cow frequently remaining in good flesh and maintaining milk-production. We suggested in such cases that the animal be retained through the lactation period and then slaughtered. This plan is fraught with considerable danger, since enormous numbers of the bacilli are passed with each micturition and the liability of spreading the disease is great. The most expedient plan is to eliminate known cases from the herd and to discover as soon as possible, by examination of urine, more recent infections. Unfortunately allergic phenomena, such as ophthalmic or intracutaneous inoculation of filtered broth cultures, have given no satisfactory results. Blood tests in our hands have proved of little value in detecting infected cows. The specific diagnosis rests on the examination of the urine, since the diphtheroids are easily demonstrated in the urinary sediment.

Up to this time various therapeutic measures have been reported but with little success. That the infectious agent is of relatively low virulence must be conceded. In two instances we have observed spontaneous recovery. In both instances the urine contained blood-cells and the diphtheroids in large numbers when first examined, but later examinations were negative.

In one instance we autopsied a cow that had been treated *per os* with methylene blue. Both kidneys were so badly involved that the animal was rejected for food.

Two cases we treated experimentally by intravenous injections of mercurochrome. The drug was readily eliminated in the urine but as far as we could determine by bacteriolgical examination the process was not arrested. Autopsy confirmed the clinical findings. Two other cows were treated with acri- and proflavine intravenously with the same negative results. In another instance the bladder was washed twice daily with ½ per cent sodium bicarbonate and then the flavine solutions instilled and the animal made to retain the solution for considerable periods. This treatment failed to alleviate the condition. It should be noted that both mercurochrome and the flavines have a high bactericidal efficiency for the organism *in vitro*.

SUMMARY

Attention has been called to a specific infectious disease of cows involving the bladder, ureters, and kidneys. It has been brought out that the condition is independent of other disease processes and that the bacterial agent is a parasite of the urinary tract only.

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DISCUSSION

DR. RALPH B. LITTLE: I have a few suggestions which may be of some some value to the veterinarian. When the symptoms are first seen and attract the attention of the veterinarian or owner, the disease is generally well established in the bladder. In the early stages the first symptom noticed is dysuria. Generally two or more attempts are made to void the residual urine and as a rule the residual urine is clouded; contains fibrin and clots of blood. As the disease progresses, the symptoms become more intensified; the cow is unthrifty, there is emaciation, atony of the rumen and inappetence. In the later stages there is a diminution in milk.

In two cases which came under our observation, paralysis was the first symptom presented. After the animals were down, it was found that the urine was bloody. A diagnosis of pyelonephritis was made by a bacteriological examination of the urine in these two animals. It was not known, however, whether the paralysis was due to the disease of the bladder and kidneys. We believe that the common genital diseases do not predispose animals to this specific type of infection.

It is possible that the infection in the bladder is intensified and becomes well established during the dry period. When pregnant cows, just prior to parturition, are taken from the milking-barns to the dry quarters, there is a considerable change in the ration. Dry fodder as a rule is substituted for the more succulent foods. Due to the changes in the rations and the pressure of the gravid uterus, pregnant cows urinate less frequently than animals in the milking-line. The retention of the urine affords the proper medium for the growth of the diphtheroid bacillus, and this disease probably becomes well established in the bladder during this stage of gestation.

A veterinarian, by making a careful examination per rectum, can be of great aid to the owner in deciding the future value of the diseased animal. He must determine the following points: Is it advisable to operate on this animal or treat it, and is it better to keep this animal in the herd as a source of infection to other cows? Finally, is it advisable to slaughter the cow for food purposes?

In two herds considerable progress has been made in eliminating the infection by examining the urine from each cow. The urine is tested for albumin. In one herd of 250 cows the managers have practically eliminated the infection by employing this procedure, while in a second herd the disease is well under control.

CHAIRMAN FROST: This is a comparatively new subject and one that seems to be becoming important.

In our experience with this disease, we have attempted, in a few cases where we thought we had only one kidney involved, to remove that kidney, and invariably our results have not been satisfactory. The animal seemed to do well for a short time, but in about three weeks at the longest, you would have a postmortem and then you would find the other kidney involved. In those cases, with any examination that you could make per rectum or even after you have opened the abdomen, you could not tell that the kidney was involved. We removed what we supposed was the diseased kidney, put the animal on antiseptics and later on had the animal die with practically the same condition in the opposite kidney.

With regard to treatment, we have attempted treatment with acriflavine, with antiseptics which are eliminated through the urinary tract, and the results have been about the same in all of them. We injected mercurochrome. The result has been practically the same in all of them. So that the best advice which we can give to the owner is that if the animal is in condition, to slaughter her immediately and get what he can from her.

BUREAU TRANSFERS

Dr. W. H. Seabrook, from Brooklyn, N. Y., to New York, N. Y., on meat inspection.

Dr. Clarence T. Snyder (K. C. V. C. '14), from Sidney, Ohio, to St. Louis, Mo., on meat inspection.

Dr. C. A. Barrett (Ind. '09), from St. Louis, Mo., to National Stock Yards, Ill., on meat inspection.

Dr. Charles H. Hart (Chi. '11), from Buffalo, N. Y., to South St. Paul, Minn., on meat inspection.

Dr. Ralph E. Nelson (Colo. '21), from Augusta, Me., to Madison, Wis., on tuberculosis eradication.

Dr. Warren B. Henneberger (U. P. '06), from Olympia, Wash., to South St. Paul, Minn., on meat inspection.

Dr. John A. Carlson, from Austin, Minn., to Omaha, Nebr., on meat inspection.

Dr. Wallace L. Williamson (O. S. U. '15), from Omaha, Nebr., to Austin, Minn., on meat inspection.

Dr. George W. Knorr (Chi. '02), from Chicago, Ill., to Frankfort, Ind., in charge of meat inspection.

Dr. Paul E. Nulk (O. S. U. '12), from Indianapolis, Ind., to East St. Louis, Ill., on virus-serum control.

Dr. W. B. Stegner (McK. '18), from virus-serum control to meat inspection, Omaha, Nebr.

Dr. Walter H. Hannemann (K. C. V. C. '18), from Chicago, Ill., to Kansas City, Mo., on meat inspection.

Dr. Stephen H. Hopkins (Chi. '10), from Chicago, Ill., to Topeka, Kans., on hog cholera control and tuberculosis eradication.

Dr. Peter A. Franzmann (Cin. '09), from Seattle, Wash., to Tacoma, Wash., on meat inspection.

REPORT OF A CASE OF ABORTION INDUCED BY VIBRIO FETUS

By E. H. Barger

University Farm, Davis, California

Probably the first authentic record of *Vibrio fetus* infection is that found in the report of the departmental committee on epizootic abortion in the Great Britain Board of Agriculture and Fisheries[1] in 1913, in which the occurrence of vibrionic abortion in sheep is mentioned. Theobald Smith[2] calls attention to the fact that, buried in that report, is the brief statement that vibrio-like forms had been isolated from cases of abortion in cattle in Ireland and Wales in 1911. No details are given and the extent of the disease at that time is therefore unknown.

Apparently nothing more concerning vibrionic abortion in cattle appears in the literature until the report of Smith[2] concerning his findings in 1917. It appears that his discovery of vibrios associated with bovine abortions came about during the routine study of placentas and fetuses from an abortion outbreak in New Jersey cattle. His attention was directed toward finding the cause of premature expulsions of fetuses and retained placentas in cattle which had given negative cultures for *Bact. abortus*. A vibrio-like organism was encountered in sufficient numbers to warrant suspecting that it played a role in the production of many cases of abortion.

It appears that the spirillum found in sheep in England by Stockman and Stewart did not differ in any important respects from that isolated by Smith from cattle. Vibrio-like forms have also been found associated with bovine abortion by Thomsen, in Denmark, and Lerche, in Germany.

Local History

At this station it is customary to test the beef and dairy herds regularly for *Bact. abortus* infection, by means of the agglutination reaction, and each herd is segregated into positive and negative groups as determined by the blood reactions.

On April 17, 1926, a red Angus cow (Lulu of U. F.) belonging to the beef herd was reported to have aborted. She was known to belong to the negative group, and upon looking up the history

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of the animal it was found that she was 12 years old, and had never given the slightest reaction to indicate Bang's infection.

The fact that this Angus had given a negative abortion reaction but a short time before expelling the fetus was the incentive to find the abort if possible. It was soon located in the field where the animals were pastured, with the dam in the near vicinity. The placenta was still retained and the advanced degree of decomposition of the membranes, together with their peculiar appearance, suggested that this case might be different in some respects from those induced by *Bact. abortus*.

The following description of the fetus is taken from notes made at the time of culturing it:

> The fetus was a male about five months developed and appeared very plump, due to a well-defined anasarcous condition. Upon being opened there was present a profuse exudation of sero-sanguineous fluid into all cavities. The liver was very dark, friable and passively congested, spleen pale, gray and flabby, but tough, resembling a piece of soaked leather upon palpation. Kidneys were normal in color but of a very tough texture and the gland was surrounded by a considerable amount of bloody fluid under the capsule. The lungs were surrounded by a large amount of blood-tinged, watery fluid, and had the usual appearance of lungs which have not functioned. Stomachs were normal in size but well filled with stringy mucoid material of a greenish tinge, in which were suspended large numbers of yellow flaky flocculi of variable size.

The placenta was tightly retained and it was necessary to remove it manually. It was of reddish-brown color and especially odoriferous considering the short time elapsing since the abortion had occurred. Instead of having the moist appearance of normal membranes, these were withered, tough and leathery, giving a waxy feeling upon palpation.

The total amount of membranes removed was very small considering the size of the fetus, but further examination failed to reveal any having been left in the uterus. The villi of the chorion were necrotic and grayish in color, while the remainder of the chorion was covered with a grayish, slimy, tenacious film.

Culture Methods

Even though the fetus was from a negative cow, as determined by the agglutination reaction, cultures for *Bact. abortus* were made from it by the usual method. Pieces of liver, lung and spleen as well as stomach contents were smeared over the surface of gentian-violet agar and the tubes incubated at 37.5° C. in a Novy jar in which approximately 10 per cent of the air was replaced by CO_2.

Extensive additional cultures were also made from the fetus, using stomach contents and pieces of lung, liver, spleen and

kidney as inocula. Plain agar, dextrose agar and plain agar plus 5 per cent defibrinated horse-blood, all adjusted to pH 7.0 were the media used for these inoculations. The tubes were sealed with wax and incubated at 37.5° C.

Examination of the tubes after three days revealed growth in those sealed with wax, while those inoculated for *Bact. abortus* showed no visible growth and subsequently remained sterile. The colonies were fine, pin-point, bluish, smoky areas from 1-3 mm. in diameter and visibly raised above the surface of the agar. The number of colonies varied greatly, but the kidney cultures showed more colonies than did those from the other organs. The colonies grew in the wake of the inoculum as it had slid down the surface of the slant. Growth appeared along the edges of the agar as a fine, thread-like filament, extending upward from the condensation fluid. A thin grayish film, easily overlooked except on close inspection, extended into the capillary space between the agar and the inner surface of the tube. The surface growth closely resembled that of *Bact. abortus*, so much so that when the tubes were first inspected somewhat superficially it was believed that the growth was *Bact. abortus*. It was noticed that growth was more vigorous and the colonies larger on the blood-agar than on the other varieties of culture media.

Subsequent staining showed the colonies to be made up of vibrio-like forms, which stained readily with carbol-fuchsin and less intensely with Loeffler's alkaline methylene blue. The organism was Gram-negative. Various forms were present, ranging from short, relatively thick organisms with a single curve, to a long slender type having numerous curves. Actual measurements gave an average width of 1.5-2 microns with the length ranging from 3-25 microns. Hanging-drop preparations showed a sluggish motility. Slender granular, monotrichic flagella were demonstrated by Muir's modification of the Pittfield method.

Smith states that the short forms predominated in his cultures at first, gradually changing to the long type, but with our strain the reverse was true. While there were many long forms present when first isolated, it was only occasionally that one was found in old cultures. The older short forms appeared granular regardless of staining process, there being present deep-staining roundish bodies in the body of the vibrio. About three days were necessary

for growth to appear, and after the first ten or twelve generations the coccoid bodies were first noticed in stained smears.

The older the cultures (i. e., the time allowed to stand) the more numerous were these bodies. If the growth was stained within one or two days after appearing, they were not so numerous, although a few of the bodies were always present regardless of the age of the culture. It is barely possible that these bodies represent some resting stage of the organism, assumed in an effort to resist the deleterious action of its own by-products. Their exact nature has not yet been explained, to our knowledge.

Considering the vigorous growth at isolation, no great difficulty was anticipated in maintaining the strain by transfers. From Smith's work it was evident that frequent transfers were necessary to insure the culture living because of variable lengths of time which some of his cultures lived without being transferred. Much difficulty was encountered in this respect, however, and for some generations the only growth obtained was on blood-agar although both plain and dextrose agar were inoculated at each transfer. Some generations grew well, others very feebly, and there was a noticeable difference in the length of time required for growth to appear after inoculation.

The cultures were kept alive for over ten months, transfers being made not less than twice monthly, and in most instances each week. Beginning at about the fifth generation it was noticed that the condensation water was invaded freely by the organisms, while before this most of the growth had been confined to areas on the agar. In a short time after inoculation this fluid became turbid and very mucoid and staining showed the fluid to be a very favorable substance for growth as it was teeming with vibrios. In an effort to induce more rapid growth of the organism for agglutination antigen production, many kinds of media were inoculated.

Table I indicates the results obtained in this connection. With the exception of Dorset's egg medium the pH reactions of all media were varied from 6.4 to 7.2 in steps of 0.2 to determine a possible maximum growth titre. Growth was variable in the reactions below and above 7.0 but was most vigorous at 7.0 in those media in which any growth occurred at all.

Negative results were obtained when the following sugars were inoculated, also in the same sugars plus 10 per cent horse serum: dextrose, maltose, mannite, raffinose, levulose, arabinose, lactose, inulin and saccharose.

TABLE I—*Results of cultivation of vibrio on various media*

MEDIUM		RESULTS
Plain agar 2%		Fair at 7.0
Dextrose agar 2%		Fair at 7.0
Dextrose agar (2%)	1%	Fair at 7.0
	2%	Slight at 7.0
+	3%	Slight at 7.0
	4%	No growth
Glycerin	5%	No growth
Plain agar 2% + horse blood 5%		Fair growth at 7.0
Plain agar 2% + horse serum 10%		Good at 7.0
Plain bouillon		No growth
Dextrose bouillon		No growth
Dorset's egg medium		No growth

The result of these tests showed that plain nutrient agar, to which had been added 10 per cent horse serum and adjusted to pH 7.0 was the best medium for the growth of the organism, and the use of the others was discontinued. A remarkable increase in rate and extent of growth was noticed in this medium after the first transfer to it. This proved a better medium than the agar plus whole blood, from the standpoint of growth and subsequent antigen production, since washings from the blood-agar were always stained with hemoglobin, rendering their use as antigen very difficult.

At the third generation, when growth was apparently assured, some of the tubes were washed down with physiological saline solution and a small amount of suspension obtained of about the density of tube 1 of the McFarland nephelometer. To this was added phenol to the extent of 0.5 per cent as preservative. Blood-serum from the cow (Lulu of U. F.) which had aborted the fetus, was set up in agglutination tests with the antigen. Cross-tests were also set up as follows:

	1–50	1–100	1–200	1–500
Lulu of U. F. *vs.* vibrio antigen	+	+	+	+
Lulu of U. F. *vs.* abortion antigen	—	—	—	—
Positive abortion serum *vs.* vibrio antigen	+	—	—	—
Negative abortion serum *vs.* vibrio antigen	±	—	—	—

These reactions were obtained approximately one month after the isolation of the organisms. A subsequent test on October 24, 1926 (6 months later), with freshly drawn serum from Lulu of

U. F. was entirely negative, indicating that either the infection had been eliminated or if still present was not of sufficient antigenic strength to induce antibody formation. The antigen for this later test was obtained from cultures of the 28th generation, which might possibly indicate that the organism had lost its sensitiveness to agglutinin reaction by that time. A further agglutination test on February 24, 1927 (10 months later), proved entirely negative.

Toxicity Tests

A single toxicity test upon guinea pigs was conducted, using organisms from the third generation. Three guinea pigs were inoculated with 1 cc each of a suspension of the culture having a denisty of 2 by the McFarland nephelometer.

The animals were killed and bled two months later and serum obtained for agglutination tests.

	1–50	1–100	1–200	1–500
G. P. 1 (1 cc orally) No lesions	—	—	—	—
G. P. 2 (1 cc subcutaneously) No lesions	—	—	—	—
G. P. 3 (1 cc intra-abdominally) No lesions	—	—	—	—

Cultures of the liver, lungs and spleen of all pigs remained sterile.

Case 2

On November 20, 1926, a Shorthorn heifer, belonging to the same herd in the same negative group as the first animal, aborted a 4½-months fetus. This heifer had been persistently negative to the agglutination test for *Bact. abortus* infection. The membranes were not retained in this case and did not differ markedly from normal membranes except for a beginning necrosis of the villi of the chorion. The abort presented much the same appearance as that of the first fetus. It was hairless and had a somewhat anasarcous appearance. Extensive cultures on various media were made, using pieces of liver, lung, spleen and kidney, as well as stomach contents as inocula. Smears made direct from the stomach contents, placentae and organs failed to reveal any vibrionic forms. Cultures of *Bact. abortus* also were made but remained sterile.

The cultures were badly contaminated, staphylococci, streptococci and unidentified forms being present. On one tube, inoculated with kidney, however, three small pin-point colonies were

noticed which resembled macroscopically those of *Vibrio fetus* and staining proved them to be an impure culture of vibrios. An effort was made to secure the organisms in pure culture but contamination soon obliterated the vibrionic growth, so nothing concerning its growth or cultural characteristics could be ascertained.

The occurrence of a vibrio-induced abortion in an animal twelve years of age is of particular interest because of the time of its appearance. It has been proved that the infection does exist in first-calf heifers, and the abortion by the Shorthorn heifer might be attributed to infection picked up at the time the older cow aborted.

Animals have been added to the herd from time to time but the heifer is a native of the herd. The fact that the Angus cow has for years produced healthy normal calves might lead to the conclusion that either she has been long infected, with no abortions, or that the infection has been recently derived from an unknown source.

It would appear that in this case there has not been a rapid spread of vibrio infection in the herd. No attempt at isolation or control has been made.

Conclusions

1. Two cases of vibrionic abortion occurred in a *Bact. abortus*-free herd, one in an aged cow, the other in a first-calf heifer.
2. There apparently has been no marked spread of the infection despite the absence of isolation measures, although it is possible that the heifer became infected at the time the older cow aborted.
3. Observations upon this herd are being continued.

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TUBERCULOSIS ERADICATION IN MICHIGAN

Of the eighty-three counties in the state of Michigan, forty-two are now designated as modified accredited areas and in twenty-four counties area work is in progress at the present time. There are eleven counties on the waiting list, leaving only six counties in which no action has been taken. These counties are Alcona, Alpena, Bay, Chippewa, Ionia and Midland.

PLANTS OF MICHIGAN POISONOUS TO LIVE STOCK*

By E. F. Woodcock

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I realize the veterinarians of the State in general are not interested in poisonous plants to any great extent because of the fact that there is not a great deal of disease or trouble caused by poisonous plants in Michigan. Nevertheless, I think there is some interest evident. As proof of this, we have a great many inquiries coming into the Botany Department to ascertain what causes animals to die, and, occasionally, some member of the Botany Department, either myself or some other person, goes out with a vetérinarian to investigate the cause of the death of stock.

I made a very careful study, in 1925, of the distribution and the number of poisonous plants in this state, and went through all the literature available on poisonous plants, checking up with the plant lists of this state. I was able to make a list of 156 plants that are more or less poisonous. The list includes both plants that poison stock and those that poison human beings, and also plants that were reported as poisonous.

Algae are not considered as poisonous to stock. The only poisonous condition they have is associated with them as they are decomposing. A few years ago I was called to go with a veterinarian to Pine Lake, near Haslett, to investigate the cause of the pigsty-like odor at the north end of the lake. We found that algae had been pushed by the wind to that end of the lake and deposited on the shore where they were decaying and producing the peculiar odor. There recently came to my attention a case in the southern part of the State where a pond had become covered with algae, and stock poisoned from drinking the water. The poisoning apparently resulted from the algae taken by the animals along with the water.

A great amount of work has been done by different investigators to determine the cause of forage poisoning, but as yet only conflicting and unsatisfactory results have been obtained. The feeding of moldy silage, spoiled hay, or immature corn often produced the disease. The cause has been attributed, by many

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investigators, to poisons secreted by molds on corn and hay. Efforts to determine which of the several molds occurring on moldy forage produce the poisons have been unsuccessful.

Forage Poisoning Investigations

Graham, Brueckner and Pontius, at the Kentucky Agricultural Experiment Station, have obtained some very promising results from a bacteriological standpoint. They isolated from the moldy hay that had caused a typical case of forage poisoning, a bacillus closely resembling *Bacillus botulinus*, the botulism organism. Typical cases of forage poisoning were produced in horses, mules and guinea pigs fed pure cultures of the bacillus. Toxins, produced before the forage is eaten, apparently cause the disease. Antitoxic serum made from *Bacillus botulinus* was found to produce immunity from the effects of the bacillus cultured from the poisonous hay. It was further found that the water in which moldy hay had been steeped would not produce forage poisoning in animals protected by botulinus antitoxin. Food samples from widely separated parts of the country, which had produced forage poisoning, were found to contain the same bacillus. The Kentucky investigators have thus proved that one cause of forage poisoning is a bacillus which resembles *Bacillus botulinus* so closely that morphological investigation has thus far not disclosed any differential characteristics. In 1923 seven samples of silage, two of bran, two of oats, and one of oat straw were received by Michigan State College Experiment Station, as being suspected of causing poisoning. Of these samples only two showed any indication of a poisonous substance and both of these were found to be capable of producing a toxin sufficiently toxic to kill a guinea pig in twelve hours, with symptoms resembling those of botulism.

The first evidence of the disease is usually a marked weakness and staggering, accompanied by a tendency of the animal to stumble over ordinary low obstructions. There appears a salivation and difficulty in swallowing, due to the paralysis of the muscles of the tongue and throat. The animal soon becomes violent, rushing about in a circle and crashing into any object which may happen to be in his way. He soon passes into a stupor, gradually losing control of his muscles and falling to the floor. The paralysis extends to the bladder and bowels which fail to function unless artificially stimulated.

The fungi growing on clover, towards the end of the season, are not poisonous, although they are so considered by many farmers.

Of the various ferns the Brake (*Pteris aquilina* L.) is the most poisonous, and the most widely distributed, it being found under varying soil conditions growing in the shaded parts of pastures, old hay-fields, and also in open woods. The leaves of the fern appearing above the ground are from one to three feet tall. Its creeping underground stem is somewhat less than a half-inch in diameter, glossy, dark colored, and often twenty feet or more in length, penetrating the soil deeply. The firm upright leaf is three-parted, each segment of which is in turn divided. The foliage of the leaf is restricted to the summit, thus causing a plot of brakes to appear solid from above and like a miniature open forest from within. No other native fern has this distinctive character. The young uncurled leaves are gray and softly wooly, and when unrolling resemble the claw of a large bird. When ripe the fruiting leaves have a continuous edging of brown sporangia, which are at first covered by the infolding margin of the leaflets.

Very little is known concerning the poisonous properties of this plant but it has long been under suspicion. Proof of its poisonous nature was published, in 1917, by the Canadian Department of Agriculture. The disease called "staggers" is caused by the Brake fern.

Field Horsetail

Field horsetail (*Equisetum arvense* L.) is a very common plant throughout the State and is very poisonous when fed in the dry condition. It grows best in poor, light, sandy soil, especially along railroads. In the early spring there appear colonies of the fertile stems of these plants which are cylindrical, light brown, leafless stalks, four to eight inches high, pointed, hollow and tipped with yellowish, club-shaped, spore-bearing heads. Each joint is ridged and grooved and covered with a toothed sheath. These stems are readily pulled apart at the joints. These early, fertile stems scatter their spores, wither and die in a few weeks. Later in the summer, from the same perennial, creeping, jointed and branching rootstocks arise, the green, plume-like, sterile stems of which are poisonous to stock when fed in the dried condition. These stems are eight to twelve inches tall, also hollow and jointed, but bear whorls of simple

rough branches, which are from three to four-angled and jointed but not hollow. These green parts of the plant manufacture the food for the plant and store it in the underground portion ready for use in the spring.

The old idea was that the silicon, a prominent and common constituent of the plant, produced internal mechanical injuries when eaten. This conception has been largely abandoned in favor of a chemical basis. It is not known definitely what is the nature of the poison, but aconitic acid and equisetin, an alkaloid nerve poison, have been found and suspected. Whatever the nature of the poison, it is especially injurious to horses. In one very interesting case, nine well-fed horses acquired the habit of eating their bedding which consisted of swale hay in which horsetail was present. The youngest, three years old, soon became unable to stand and died within a few days. The other somewhat older horses became very ill but recovered after a time. The oldest of the group, a mare, showed only slight symptoms. Five other similarly fed horses, but bedded with clean straw, remained healthy.

One of the symptoms of horsetail poisoning is the development of a depraved appetite. As the disease progresses diarrhea and rapid loss of flesh are evident, followed by incoördination of muscles, swaying, staggering, and inability to stand. Temperature at first below normal, later rising, due to the struggles of the animal to get upon its feet. The extremities are cold and the mucous membranes are pale, due to poor circulation. In cases of long standing the animals become thin and take on a general unthrifty appearance.

Squirrel-tail Grass

Grasses as a group are not considered very poisonous, but in discussing poisonous plants, you have to consider a plant poisonous even though its immediate effect is only a tearing of the flesh. Infection may enter through the break in the skin and the plant, thereby, be indirectly poisonous. Squirrel-tail grass (*Hordeum jubatum* L.) (fig. 1) is quite injurious to stock. It is sometimes called skunk grass, wild barley, and tickle grass. It growns along roadsides, and in waste places, preferring slightly moist soil. The stems arise in clumps from compact masses of tangled fibrous roots, and are from six inches to two feet tall, with narrow slender leaves, and dense heads. These fruiting spikes or heads turn yellow early in the season and when mature

are distinguished from ordinary foxtail or millet by the conspicuous slender awns which stand out from the head giving a resemblance to a squirrel's or skunk's tail. The spike axis is jointed, each joint bearing one seed placed between two sterile flowers. At maturity the spikes break apart at the joints in such a way that each segment bears one mature seed accom-

FIG. 1. Squirrel-tail grass (*Hordeum jubatum* L.).

Other common names are skunk grass and wild barley. Spike axis is very slender, soon breaking at each joint, the lower portion of which is barbed and sharp-pointed, making a formidable weapon to pierce the gums of cattle and sheep.

panied by seven long barbed awns. The long barbed awns become very brittle when ripe, and break into small pieces, which work their way between the teeth and into the jaws of animals that eat the grass, causing ulcerations and swellings which are sometimes mistaken for actinomycosis. They get into the nostrils and into the eyes, sometimes even causing

FIG. 2. Porcupine grass (*Stipa spartea* Trin.).

A graceful, erect, tufted perennial and a pernicious weed, on account of its barbed "seeds" and coiled awn which, upon uncoiling in the wool or hair of animals in the presence of moisture, forces the "seed" into the flesh.

blindness. The tissues of the throat and alimentary canal may also be irritated and ulcerated.

Porcupine Grass

The seed of porcupine grass (*Stipa spartea* Trin.) (fig. 2) is about one inch long and its lower part is clothed with short rigid hairs and the point of the seed is stiff and sharp-pointed. Attached to the upper end of the seed is an awn six inches long,

Fig. 3. Corn cockle (*Agrostemma githago* L.).

A tall, silky, erect, fall annual; 1-3 feet high; flowers large, red or pink, common in wheat fields. Seeds black, poisonous.

rough, stiff, strongly twisted for half its length, and usually having a double bend beyond the straight spiral. This spirally twisted awn relaxes when damp and tightens again when dry, enabling the seed to bore its way into the soil with the sharp

FIG. 4. Water hemlock (*Cicuta maculata* L.).

A rather slender, stiff, open-topped perennial; 3-7 feet high, having fleshy roots; leaves compound, the segments toothed along margin; flowers white; fruit borne in compound umbels. Common on low, moist land in southern part of Lower Peninsula. Roots and young stems very poisonous to stock

beak at the base. If caught in the wool of a sheep it bores just as readily into the flesh of the animal, the stiff hairs near the base of the seed holding it in place while the awn twists and untwists through days of torment, making sores which injure the quality of the wool and sometimes endanger the creature's life. Hay containing the broken awns, when fed to stock, may cause serious inflammation in the stomach and intestines.

Corn Cockle

Corn cockle (*Agrostemma githago* L.) (fig. 3) is a weed commonly found in wheat fields, its presence being due to the fact that corn cockle seed is often mixed with the wheat seed when sown. The seed is poisonous and when ground with wheat the flour is rendered unwholesome and even dangerous as food. Poultry and other animals have been killed when fed with screenings composed largely of seeds of cockle.

The stem of the plant is erect, slender, one to three feet tall, simple or with a few branches near the top. It is clothed with whitish hairs closely pressed against the surface of the plant. Leaves opposite, two to four inches long, narrow, oval, and pointed at each end. Flowers terminal on long hairy stalks and are often an inch and a half broad, with five spreading purple petals, which are slightly notched at the outer edge. The calyx or green leaf-like part of the flower is very hairy and has five pointed lobes extending out between the purple petals.

Water Hemlock

Cowbane or water hemlock (*Cicuta maculata* L.) (fig. 4) has caused much loss of live stock in Michigan. The roots are two to four inches long, thick, tuberous and bunched in a cluster at the swollen base of the stem. They are quite similar to artichokes or parsnips and are often mistaken for them in the early spring. In reality they are quite easily distinguishable, since the parsnip has only one main fleshy root while the water hemlock has several fleshy roots at the base of the stem. The stems are stout, smooth, hollow, two to six feet tall and streaked with brown and purple, the color being more evident at the junction of the stems and branches. The basal portion of the stem is slightly swollen and has several closely placed partitions across the hollow central region. The leaves are compound, having a main axis like a feather and lateral axes which bear the thin, narrow leaflets. The flower cluster is open and spreading like an umbrella, resembling somewhat the parsnip flower cluster.

The individual flowers are very small, each bearing five small white petals.

The plants are perennials, growing in wet meadows and marshy places. Each season the cluster of fleshy roots sends up a stem. In the early spring the roots are frequently forced out of the earth by washing or freezing, or cattle and sheep may bite the young shoots and in that way remove the roots from the wet soil. The young shoots in spring are especially attractive when other green stuff is scarce. Experiments show that the stems and seeds in hay are not poisonous. Cattle, horses, sheep and hogs are all susceptible to the poison. Human beings, especially children, are often poisoned by eating the roots by mistake for artichokes or small sweet potatoes. Animals have also been reported to have been poisoned, especially in the spring, by drinking water from wet places where the water hemlock grew, the poisons having been derived from the juices of the roots crushed by the trampling of the animals themselves. Horses have been killed by eating the roots upturned by the plow. Hogs obtain the roots by rooting in the soil in the spring and during periods of drought. Of the domestic animals mentioned, cattle are the most often poisoned, a piece of root the size of a walnut being sufficient to kill a cow. The toxic principles present are the alkaloid cicutin and the bitter resinous substance cicutoxin. The general symptoms of water hemlock poisoning are frothing at the mouth and most violent convulsions. which in a short time ordinarily cause death.

Wild Black Cherry

Wild black cherry (*Padus virginiana* (L.) Mill.), choke cherry (*Padus nana* (Du Roi) Roemere) and wild red cherry (*Prunus pennsylvanica* L.) are all considered more or less poisonous. Frequent cases of poisoning in cattle have been recorded from eating the wilted leaves from branches thrown carelessly within their reach or ignorantly offered as food. The poisonous property of all species of cherry leaves is due to hydrocyanic acid, popularly known as prussic acid. This compound does not exist as such in the growing leaf but is derived from the glucosid amygdalin through the activity of a ferment which begins its work the moment the circulatory connection in the leaf is cut off. The leaves of the black cherry are the most poisonous of the three species mentioned. The prussic acid causes the blood to become a bright arterial blue and later a dark venous color due

to the paralyzing action on the respiratory center. The blood is not able to give up its carbon dioxid, since the paralyzed lungs are unable to bring in the necessary oxygen.

Castor Oil Plant

The castor oil plant (*Ricinus communis* L.) contains in its seeds the poison ricin, which remains in the pulp after the castor oil has been pressed out. These seeds have caused death in man and also in horses when eaten accidentally. Sheep also have been poisoned with them. They cause vomiting, gastric pain, bloody diarrhea and dullness of vision. The plant is ornamental, and is often cultivated. It is a smooth, branching annual, five feet or more in height, with large palmately lobed leaves. The large mottled seeds are enclosed in the somewhat spiny case.

White Snakeroot

White snakeroot (*Eupatorium urticaefolium* Reichard) is said to produce the disease known as trembles in cattle, horses and sheep, and milk sickness in people. This milk sickness is known to be due to the use of milk, butter, cheese or meat of animals afflicted with trembles. This plant is becoming quite common in the southern part of Michigan. The disease caused by the plant may appear at any season of the year but is most prevalent in late summer and autumn, especially when other vegetation is scarce because of drought. The disease is frequently fatal in domestic animals, while the sequel of milk sickness in man, in case of recovery, is lasting debility. The most prominent changes noted in the autopsies on twenty-two sheep which had died from poisoning in one case, consisted of albuminoid and fatty metamorphoses of the parenchymatous organs. The lesions commonly include petechiation of the epicardium; the presence of metallic color of the kidneys, which exhibit active and passive congestion and cloudy swelling; "nutmeg" appearance of the liver, which has undergone fatty changes and is congested, so that blood drips freely from the sectioned surface; the occurrence of muco-enteritis of the small intestine; and the presence of a congested condition of the brain and spinal cord.

The stem of the plant is very slender, much branched, smooth or nearly so, one to four feet tall. Leaves opposite, broadly ovate, pointed, large, thin, smooth, coarsely and sharply toothed, three-nerved, with long, slender petioles. Heads ("flowers") in large compound clusters, snowy white, each about one quarter of an inch broad. The flowers have a soft fringy appearance, somewhat like the garden Argeratum.

St. John's-wort

St. John's-wort (*Hypericum perforatum* L.) (fig. 5) is of peculiar interest because of the fact that when it is eaten, a substance which it contains is absorbed in the alimentary

FIG. 5. St. John's-wort (*Hypericum perforatum* L.).

A herbaceous perennial, 1-2 feet high, spreading by runners at the base; leaves without petiole, elliptical; petals deep yellow, black-dotted along the margins, twice as long as the sepals. Rather bad in old fields and meadows.

tract and deposited in the unpigmented skin, where it acts as a sensitizing agent on the tissue. The sensitized skin reacts upon exposure to sunlight, and there is set up an intense itching, which the animals attempt to reduce by vigorous scratching or rubbing, the skin sometimes being broken in their attempts to obtain relief.

FIG. 6. Ergot (*Claviceps purpurea* (Fr.) Tul.).

This is a poisonous fungus, sometimes appearing on the grains of rye, timothy, red top and other grasses. About fifteen of these growths are here represented as projecting from a spike of meadow foxtail and four large growths from a spike of rye. This growth is the over-wintering (sclerotial) stage of the fungus which has other means of reproduction next year.

The plant is a pernicious weed, difficult of suppression. The stem is ten to thirty inches tall, erect, slender, much branched, rather stiff, bearing along the side two opposing ridges which make it two-edged. Leaves opposite, oblong to elliptic, one-half of an inch to an inch long, light green, without a petiole. Flowers in terminal clusters, very showy; petals five, golden yellow, nearly one-half of an inch long, with black-dotted margins. There are several other species of this plant found in Michigan.

Ergot Poisoning

The fungus ergot (*Claviceps purpurea* (Fr.) Tul.) (fig. 6) is of especial interest because during its life history it produces a structure which is very poisonous to stock. The fungus filaments feed on and replace the cells in the seed of the affected plant, forming at the time of harvest a hard compact mass known as a sclerotium. In fact, in speaking of ergot one thinks of this structure as "ergot." This black structure, white or purplish within, is considerably larger than the normal uninfected kernel. This sclerotium is the resting or wintering stage of the fungus. In spring the sclerotium does not produce a young plant like the healthy kernel but, instead, by various stages of development it causes infection of the young developing seed in the flower and finally the sclerotium at the time of harvest. Rye is more susceptible than other cereals but wheat and oats may also suffer from the disease. Some grasses also may harbor the disease.

It is most dangerous in hay but may also cause trouble in ground feeds. The chronic form of ergotism is caused by the cumulative effects of the drug on the sympathetic or nervous system. In the gangrenous type of the disease the arteriole walls become contracted and as a result the blood has difficulty in reaching all parts of the body, especially the extremities. The tissues of the extremities, thus deprived of their blood-supply, soon show a coldness, paleness and loss of feeling. Later the tissues die, resulting in a gangrenous condition. The hoofs, ears, and tail often slough off, and sores of a gangrenous nature appear on other parts of the body. Ergot is responsible for many cases of sporadic abortion; especially in the later stages of pregnancy. The contracting action of the drug upon the walls of the uterus is made use of by physicians in obstetrical work.

Poison Ivy and Poison Sumac

In conclusion I am going to mention two plants which are seldom, if ever, poisonous to stock, but which are of much interest to men. The two plants are poison ivy (*Toxicodendron toxicodendron* L.) (fig. 7) and poison sumac (*Toxicodendron vernix* (L.) Kuntze) (fig. 7).

Poison ivy is a low shrub which is propagated by underground branches as well as by seeds. It scrambles over stumps of trees or it may climb by means of aerial roots to some height up fence-posts and trunks of trees. The long-stalked or petioled leaves are divided into three distinct leaflets, the central leaflet

Fig. 7. (Left) Poison ivy (*Toxicodendron toxicodendron* L.).

A bushy vine, climbing by aerial roots over walls and up the trunks of trees; leaves compound, consisting of three leaflets. Very poisonous to the touch of many persons.

(Right) Poison sumac (*Toxicodendron vernix* (L.) Kuntze).

A shrub or small tree, 6-15 feet high; leaflets 7-15 obovate oblong, entire. Thriving in swamps where the leaves assume very attractive tints in autumn. To many persons very poisonous to the touch.

having a short stalk of its own. The leaflets are oval, pointed, entire or with a few irregular coarse teeth. In the fall the poison ivy leaves take on rich autumnal colors. The flowers are small, inconspicuous, greenish white, and loosely clustered at the base of the leafstalk. The berries are also greenish white in color, slightly shining, round, smooth, with longitudinal ridges at intervals. The flowers are in bloom from April till June. Poison ivy is also recognized under the names poison-oak, poison-vine and three-leaved ivy.

It is the worst vegetable poison in America, hundreds of people being poisoned each year. The poisonous constituents have not yet been satisfactorily determined. Cases of poisoning are often reported where the individual has passed the plant without coming in contact with it. This has been explained by the fact that pollen grains, minute hairs and even odors from the plant are sufficient to cause eruptions on the skin of a susceptible person. The poison may even be carried on the clothing or tools of someone who has been in contact with it. Cattle do not seem to be poisoned by it, but dogs are susceptible to its poisonous nature.

The symptoms of poisoning appear as an inflammation of the skin which begins to appear from eighteen hours to several days after contamination, and is characterized by intense irritation and burning, swelling, and redness, followed by blisters and pain. Symptoms of internal poisoning are burning thirst, nausea, faintness, delirium and convulsions.

The poisoning from poison sumac or swamp sumac is similar to that from poison ivy but much more severe. The remedies are the same. This sumac is a shrub or small tree, from six to twenty feet high, with long, compound leaves, from the central axis of which arise at intervals seven to thirteen leaflets. The leaflets are about two to four inches long, and from one to one and one-half inches wide, with reddish stalks and midribs. The margin of the leaflet is not toothed. The flowers are small, green, in long, loose, open, slender flower clusters. The berries are smooth, round and greenish. The shrub is very attractive in the autumn, when the leaves change to very brilliant shades of scarlet and orange. The harmless sumacs may be very readily distinguished by their large red clusters of hairy fruits at the ends of the branches.

ANEMIA IN YOUNG PIGS

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There are many unanswered questions in connection with heavy pig losses such as have occurred during the past few years. It is sometimes very difficult to determine what factors are responsible for these losses. Perhaps the most urgent need in determining the causes of these pig losses is some definite pathologic standard by means of which the effects of various factors may be determined. The establishment of some such standard would supply a valuable basis for diagnosing pig diseases.

In the spring of 1924 there was begun a study of the pathologic findings in young pigs which were deprived of various vitamins. During the course of this study anemia was frequently encountered as a striking disease manifestation. This disease has a very definite pathology and occurs under conditions which suggest that it is of practical importance and of interest to the veterinarian.

The literature on anemia in pigs is scant. In 1890, Braasch,[1] in Schleswig-Holstein, reported an extraordinarily high death-rate among pigs, due to anemia. He said that the disease caused such heavy death losses among suckling pigs and young hogs that swine production had to be abandoned on some farms. According to Braasch, anemia in young pigs did not occur to any important extent until after the large dairy farms were established and intensive swine production was begun. He said that the disease became especially important after the so-called modern hog-house came into use. It was his opinion that anemia was caused by managing the breeding animals in a way that did not meet their natural needs.

McGowan and his coworkers[2, 3, 4, 5] recognized anemia in pigs prior to 1923. McGowan's description[5] of the gross lesions and the degenerative microscopic changes agrees quite closely with what was found during the present studies. However, we have noted some important additional histologic features which will be discussed later. McGowan believed that anemia was caused by a deficiency of iron in the ration; and that it could be pre-

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vented or cured by adding iron oxid to the ration. Moreover, he believed that anemia was identical with so-called cottonseed poisoning in pigs.

A review of the work on cottonseed poisoning in swine published by Dinwiddie,[6] Rommel and Vedder,[7] Wells and Ewing,[8] and Goldberg and Maynard[9] leaves considerable doubt in our minds as to whether or not this condition can be considered as identical with anemia. It is true that some of the gross lesions reported by some of these investigators are very similar to what occur in anemia. However, it appears unlikely that the microscopic changes which we have found to be so characteristic of anemia could have been completely overlooked by the investigators of cottonseed injury. So far as we have observed, not a single investigator of cottonseed poisoning in swine has reported finding the microscopic changes which characterized the anemic pigs in our studies.

McGowan has already called attention to the probability that some of the pig diseases reported in the literature as enzootic hepatitis were, in reality, anemia. Hutyra and Marek[10] for example, cite the observations of Semmer, Kleinpaul, and others, on important enzootics of hepatitis in pigs occurring in Russia and Germany. As another example, there are the observations of Gashuis[11] who reported that when swine were fed starch meal and were not allowed access to pasture, the young pigs—from 2 to 4 weeks of age—were attacked by a liver disease, particularly during January and February. It is not improbable that Gashuis was dealing with anemia when he made these observations.

Experimental Work

During the spring of 1924, pigs were farrowed by sows which had been kept under the experimental conditions and on the experimental rations from the time they were bred. The sows and their pigs were kept in a large, well-lighted, closed hog-house provided with a concrete floor. Vitamins were supplied to certain lots of sows and pigs by adding to the basal ration (ration 1, table I) cod-liver oil, yeast and orange juice. Anemia occurred in pigs in all lots irrespective of the vitamin content of the ration.

During the spring and fall of 1925 and the spring of 1926 experiments were continued with modification of rations and conditions. The 1925 and 1926 experiments afforded an opportunity to compare the incidence of anemia in pigs kept under

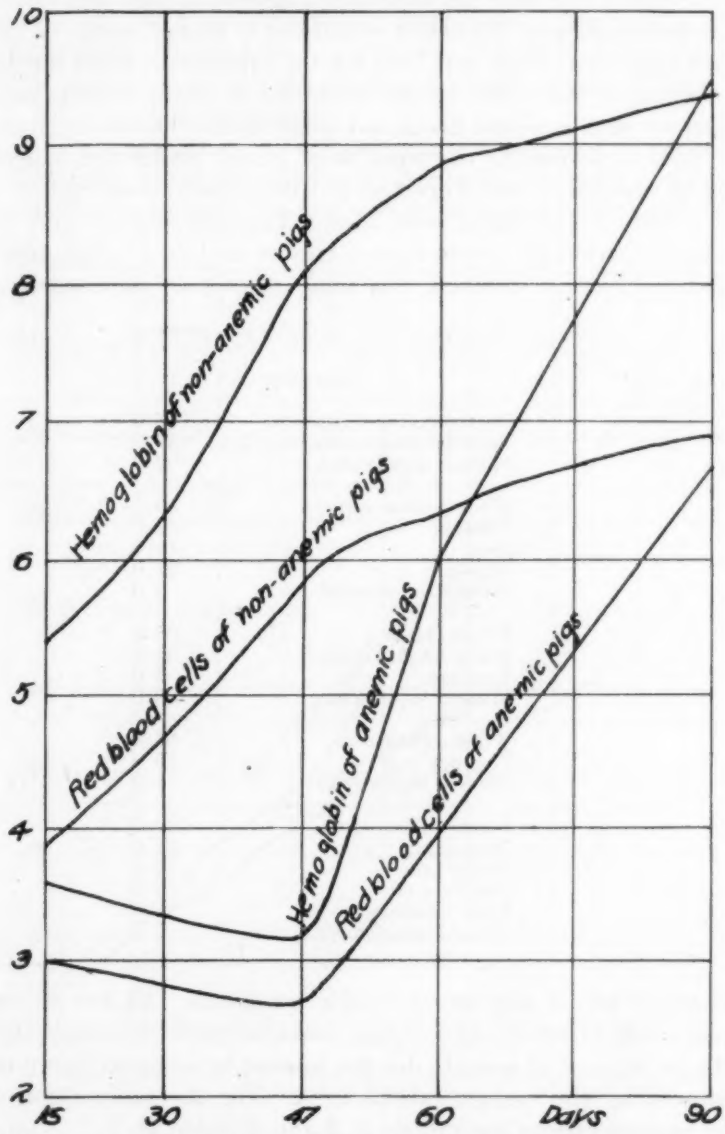

FIG. 1. Chart of curves showing the average red blood-cell and hemoglobin content of the blood of anemic and non-anemic pigs between the ages of 16 and 90 days. The data represented by these curves were obtained from the following numbers of pigs:

At 16 days of age: 37 non-anemic, 26 anemic
At 30 days of age: 36 non-anemic, 22 anemic
At 47 days of age: 34 non-anemic, 11 anemic
At 60 days of age: 30 non-anemic, 6 anemic
At 90 days of age: 13 non-amenic, 3 anemic

The curves represent the number of grams of hemoglobin per 100 cc. and the number of millions of red blood-cells per cu. mm. of blood.

inside conditions with the incidence of anemia in pigs kept under outside conditions. By inside conditions is meant, inside of the same hog-house which was used for the experiment made during the spring of 1924. By outside conditions is meant, outside pens provided with concrete floors and small shelter houses or sheds. In these experiments the sows were placed under the experimental conditions and were first fed the experimental rations a short time before they were bred. The experiments were so planned that there were always groups or lots of pigs under inside conditions receiving the same rations as corresponding

TABLE I—*Rations used in the different experiments*

RATION	COMPOSITION	
1	Degerminated white corn	37.0 lbs.
	Tankage from eviscerated hogs	37.0 "
	Mineral supplement	2.0 "
2	Whole yellow corn	50.0 "
	Tankage	10.0 "
	Bran	10.0 "
	Oats	27.0 "
	Mineral supplement	3.0 "
3	Whole yellow corn	60.0 "
	White wheat shorts	32.0 "
	Tankage	5.0 "
	Mineral supplement	3.0 "
4	Whole yellow corn	87.0 "
	Tankage	10.0 "
	Mineral supplement	3.0 "
5	Whole yellow corn	47.0 "
	Meat scrap	18.0 "
	Wheat bran	15.0 "
	Cod liver oil	3.0 "
	Flour middlings	15.0 "
	Mineral supplement	2.0 "

groups or lots of pigs under outside conditions. All lots of pigs received cod-liver oil; and certain lots also received orange juice. The occurrence of anemia did not appear to be appreciably influenced by the various rations used. For the composition of the various rations see rations 2, 3 and 4 (table I).

During the fall of 1926, another experiment was made under inside conditions, in order to observe the effect of feeding iron in the form of ferrous lactate. In this experiment there were 17 pigs, from three sows, farrowed between October 1 and 15, 1926. The sows had been kept inside since the beginning of the previous spring and had been fed ration 5 (table I). This

ration was used throughout the experiment. The results were very similar to what were previously obtained by the use of other rations under inside conditions. Eight of the 17 pigs, or 47 per cent, became anemic.

During the spring of 1927, anemia was observed to occur on a hog farm where 60 brood sows farrowed. It was the practice on this farm to keep the pigs in the farrowing-house until they

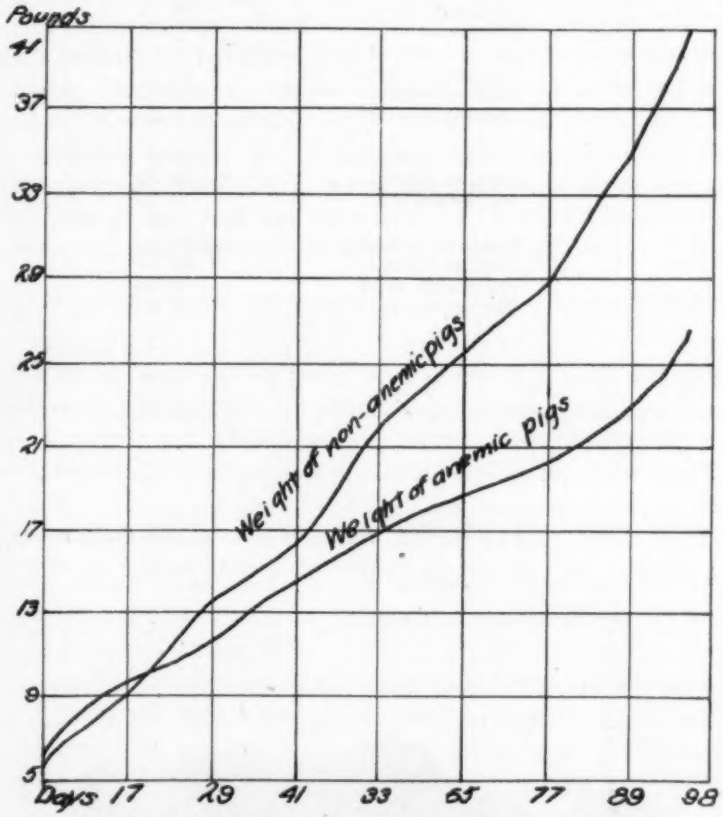

FIG. 2. Chart of curves showing the average weights of anemic and non-anemic pigs between five and 95 days of age.

were two or three weeks of age. A large proportion of the litters showed clinical evidence of anemia by the time they were three weeks of age. Red blood-cell counts were made on 59 pigs, ranging in age from two days to three weeks. Six of the 59 pigs had less than 2,000,000, and 28 others, or nearly 50 per cent, had 3,000,000 or less red cells per cu. mm. of blood. The average number of red cells per cu. mm. of blood from the 59 pigs was

TABLE II—*Mineral supplements fed with different rations*

RATION	INGREDIENTS OF MINERAL MIXTURE	
1	Wood ashes	43.0 lbs.
	Acid phosphate (16%)	43.0 "
	Sodium chlorid	10.5 "
	Potassium iodid	0.5 "
	Magnesium sulphate	3.0 "
2	Calcium carbonate	50.0 "
	Sodium chlorid	39.75 "
	Potassium iodid	0.25 "
3	Calcium carbonate	50.0 "
	Sodium chlorid	39.75 "
	Potassium iodid	0.25 "
4	Calcium carbonate	50.0 "
	Sodium chlorid	39.75 "
	Potassium iodid	0.25 "
5	Calcium carbonate	75.0 "
	Sodium chlorid	24.75 "
	Potassium iodid	0.25 "
	Ferrous lactate	1.0 "

3,200,000. Red cell counts were made on the blood of 29 additional pigs at one day of age. These day-old pigs had an average of 5,200,000 red cells per cu. mm. of blood.

These findings indicate that the pigs on this farm were born with an abundance of red cells, but that the number of cells declined rather rapidly during the early part of the extra-uterine life of the pigs. A certain degree of decline in the number of

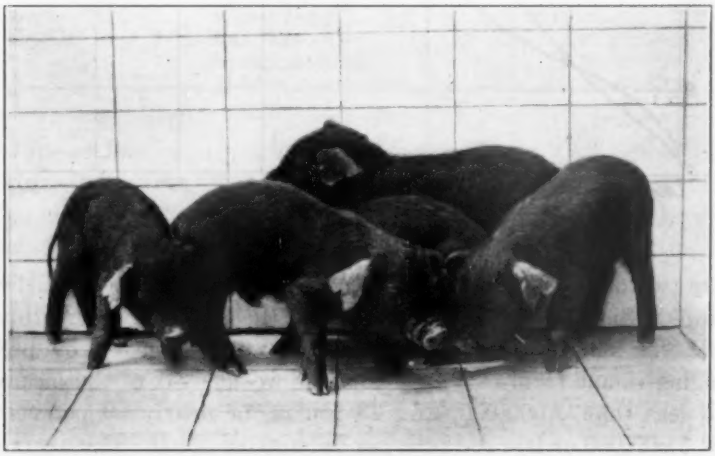

FIG. 3. The survivors in an anemic litter. About one-half of the litter died of anemia.

red blood-cells is, no doubt, a normal occurrence during the early part of the life of a pig. However, the extent to which the number declined in many of these pigs can not be considered normal.

The manager of this farm kindly consented to divide certain litters of pigs so as to enable us to make further observations on the influence of inside and outside conditions. Four litters comprising 34 pigs were divided into two groups containing 16 and 18 pigs, respectively. Each of the four litters was divided as nearly equally as possible. Each day, when the weather was favorable, the 34 pigs were taken away from the sows and the group of 18 was put outside, while the group of 16 was kept in the farrowing-house. The experiment was started during the middle part of April, 1927, when the pigs were from one to three days of age, and was continued for 26 days. During the 26 days, the pigs were outside a total of about 32 hours. While

TABLE III—*Comparison of litter mates inside and outside with access to bluegrass*

DAYS OF AGE		1	14	19	26
R. B. C.*	Inside	4.8	4.0	4.2	4.5
	Outside	5.0	3.9	4.4	5.4
Hb.	Inside	8.8		4.8	5.3
	Outside	8.8		6.6	8.5

*The red blood-cells (R. B. C.) are expressed in millions per cu. mm. of blood. The hemoglobin (Hb.) is expressed in grams per 100 cc of blood.

outside, they had access to young bluegrass. The results of red blood-cell and hemoglobin determinations on the blood of these pigs are shown in table III.

Another experiment was made in which the litters were divided and part of the pigs were put outside, in pens with concrete floors, where the pigs could not get any green feed. Five litters, comprising 41 pigs, were so divided that 17 pigs were kept inside and 24 were put outside for about two hours each day when the weather was favorable.

When the experiment was begun, three of the litters were one or two days old, one litter was five days old, and another was 19 days old. The 19-day-old litter was already anemic. The experiment was begun about the middle of April, 1927, and was continued for 35 days. The results of the red blood-cell and hemoglobin determinations made on the blood of these pigs are shown in table IV.

TABLE IV—*Comparison of litter mates inside and outside in dry lot*

DATES OF BLOOD EXAMINATIONS		4/12	4/22	5/5	5/17
R. B. C.*	Inside	3.5	3.3	2.2	3.8
	Outside	3.6	2.9	3.6	4.3
Hb.	Inside	6.8	5.2	4.9	4.7
	Outside	6.9	4.9	5.3	6.4

*See footnote, table III.

In this study we considered as anemic all pigs, three weeks or more of age, which had 3,000,000 or less red blood-cells per cu. mm. and 3.8 grams or less of hemoglobin per 100 cc of blood. From the microscopic findings which will be described later, we feel quite certain that this standard for judging anemia was a conservative one and that no non-anemic pigs were classed as anemic. The blood-cell counts were made by the usual method. The hemoglobin determinations were made according to Newcomber's[12] method.

SYMPTOMS

The clinical features of anemia are often sufficiently characteristic to warrant a diagnosis without a blood examination

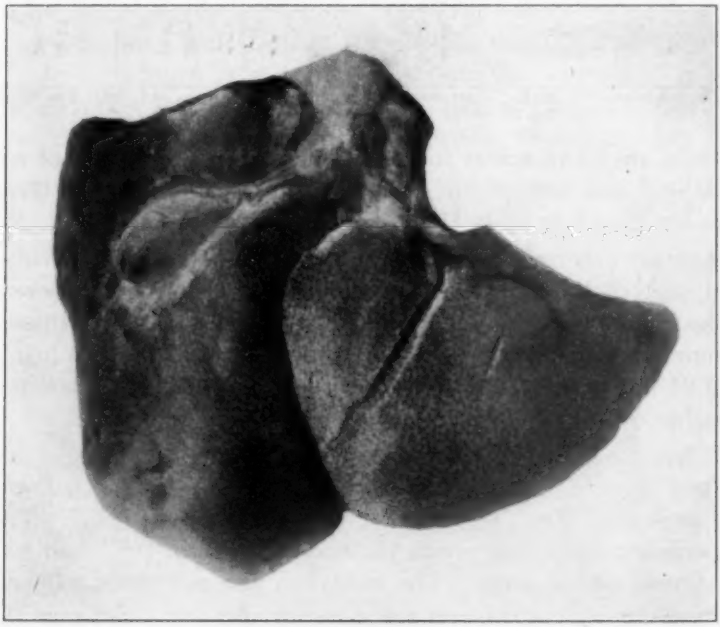

FIG. 4. The liver from an anemic pig. It shows the peculiar grayish-yellow mottling due to degenerative fatty infiltration

being made. Frequently some of the pigs in a litter show listlessness and general lack of vigor as early as one week of age. Very often such pigs are well developed and appear to be well nourished; but they lack stamina, and become fatigued and depressed after slight exertion. They usually show but little inclination to play like thrifty young pigs ordinarily do.

It is a common thing for a majority of the pigs in a litter to show clinical evidence of anemia at three weeks of age. At this age, the anemic pigs may still be fat, but show increased listlessness; and are often obviously paler than normal. This paleness is particularly noticeable in pigs which do not have much dark pigment in their skins, such as the red breeds and white breeds. The skin on the ventral side of the body and the visible mucous membranes sometimes show frank evidence of anemia when it is difficult to detect elsewhere. At about this

FIG. 5. A cross-section of the liver from an anemic pig. The areas of degenerative fatty infiltration appear as grayish mottlings throughout the liver

stage of the disease, it is fairly common for fat, apparently well-nourished, anemic pigs to die suddenly. As the disease progresses, the affected pig becomes weak and thin; the hair becomes rough and the skin wrinkled. So that the end result of anemia in a pig which lives is very often a "runt."

GROSS PATHOLOGY

The most constant gross lesions occur in the liver. It usually appears somewhat larger than normal; and there are grayish-yellow areas within the lobules, which give the whole organ a finely mottled appearance. In many cases there appears to be but little parenchymatous liver tissue left. Hemorrhages in the liver are common, and evidently result from the profound degenerative changes.

A large amount of serous fluid and masses of fibrin are very commonly found in the abdominal cavities of pigs which die of

anemia. An enlarged, firm spleen is also commonly found. The kidneys show evidence of degenerative changes in the parenchyma. The heart is nearly always pale, flabby and dilated. Quite often the dilatation of the heart is great enough to crowd the lungs partially out of their normal position. Hydrothorax and pulmonary edema occur quite commonly. The blood is pale; and the skeletal muscles and most of the visceral organs have a pallid appearance.

A few pigs which had recovered from severe anemia were examined postmortem. In these pigs there was usually more or less fibrosis of the liver. In some cases the destruction of liver parenchyma and the subsequent effort at repair had evidently been extensive, because the liver showed a cirrhosis approaching the hobnail type.

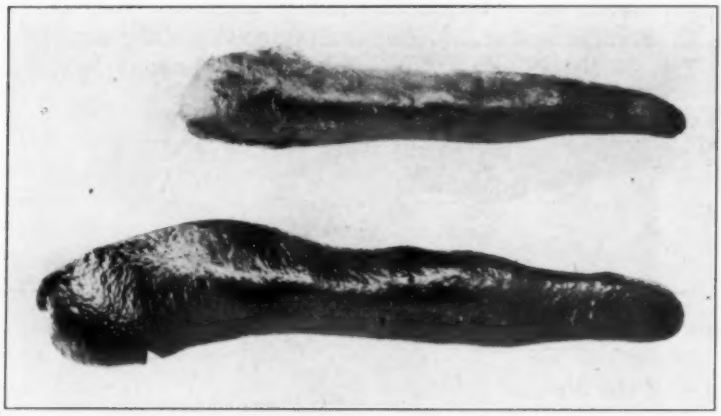

FIG. 6. Photograph showing a comparison between the size of a normal spleen and an enlarged one from an anemic pig. An enlarged, firm spleen was found to be rather common in anemic pigs

MICROSCOPIC PATHOLOGY

Microscopically, the degenerative changes in the liver are mainly fatty in nature. There are remarkably large accumulations of fat occupying portions of the lobules. In some lobules the fat is peripherally located. In others, it is centrally located. In still others the fat occupies practically the entire lobule. The remaining liver-cells often contain multiple fat droplets. Albuminous degeneration is also occasionally observed in the liver-cells. Evidence of chronic passive congestion is frequently well marked in the liver. The kidneys show both albuminous and fatty degeneration of the epithelium. The heart shows fatty degenerative changes in the myocardium.

Except for the marked fatty changes in the liver, the degenerative changes described above are not different from what may be found in a number of different diseases. Another type of microscopic change is found which is much more significant so far as the anemic state is concerned. In the liver, spleen and bone marrow, there are active hematopoietic centers. In some cases these centers in the spleen and liver are made up of erythroblastic cells, but in other cases they are composed largely of typical myelocytes. In the bone-marrow, the erythroblastic type of cell often predominates over the myelocytes.

In the spleen and liver, as well as in the bone-marrow, the erythroblastic cells are arranged mainly in clumps or nests. However, a good many of them are scattered throughout the spleen and liver. In many cases well-defined nests of these cells

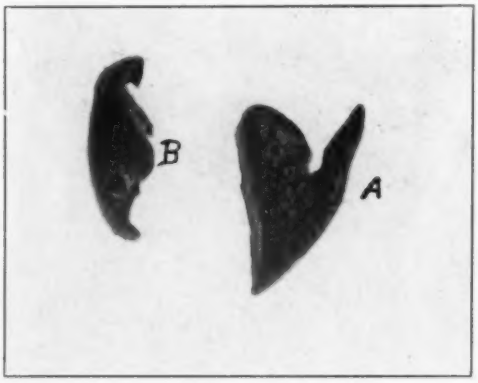

FIG. 7. Cross-sections of spleens from anemic (A) and non-anemic (B) pigs.

are found in the osteogenetic layer of the periosteum. Erythroblastic cells are also commonly found in the lymph-glands. Large numbers of eosinophiles occur often, especially in the lymph-glands. Since eosinophiles occur quite commonly in the tissues of pigs, it is not likely that their presence has any relation to anemia. It is interesting to note that in the routine microscopic examination of the various organs of experiment pigs, accessory spleens were found imbedded in the pancreases of two anemic pigs. These accessory spleens showed the same degree of myeloid transformation as was found in the main spleens.

Endothelial giant cells were remarkably numerous in the spleens of some of the anemic pigs. Multinuclear giant cells

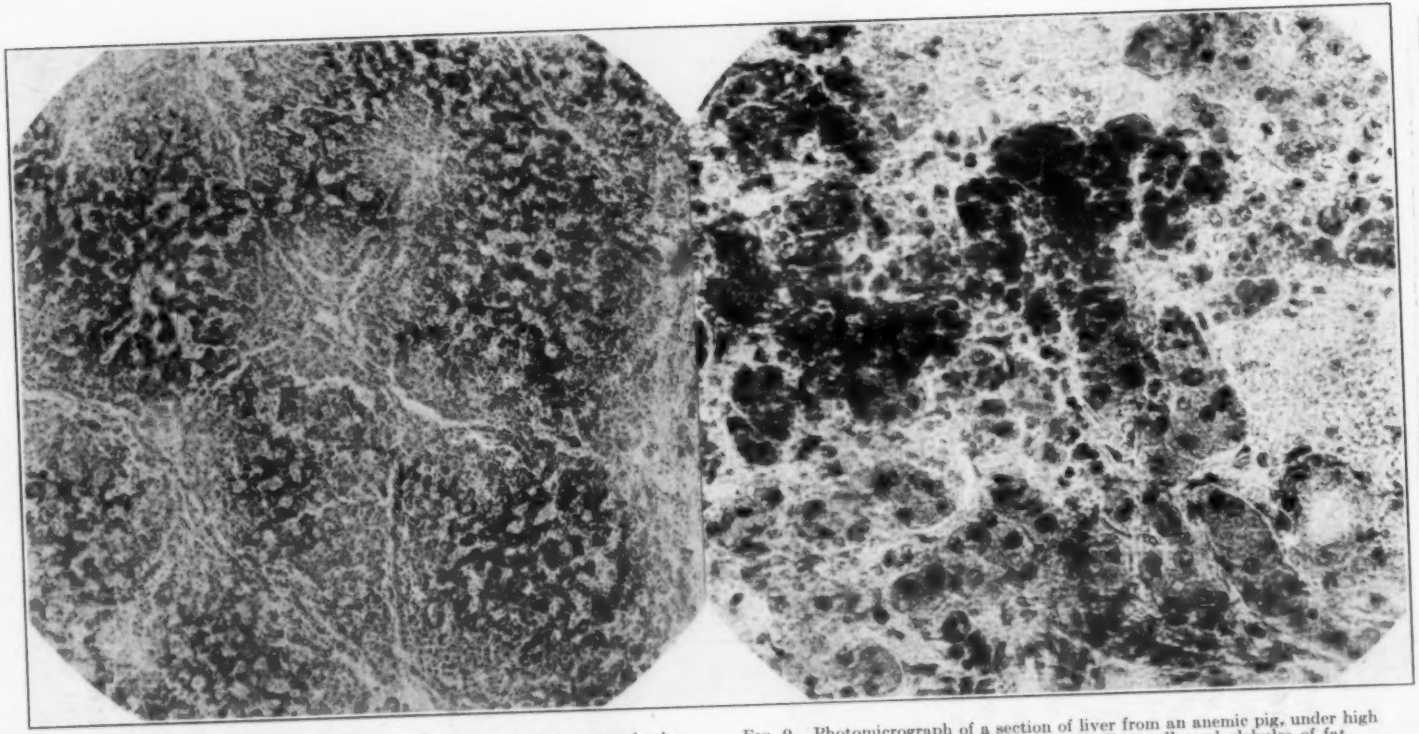

FIG. 8. Photomicrograph of a section of liver from an anemic pig under low magnification, showing the remarkable extent to which the degenerative fatty infiltration has replaced the liver parenchyma. The section was stained with Sudan III and hematoxylin; consequently the degenerative fatty material and the nuclei of the cells appear dark.

FIG. 9. Photomicrograph of a section of liver from an anemic pig, under high power. It shows fat droplets in the liver-cells and globules of fat along the margin of a degenerated area.

were commonly seen in the bone sections. However, they did not appear to be more numerous in bones of anemic pigs than in the bones of non-anemic pigs.

Apparently not many new types of cells appear in the blood during anemia. The red blood-cells of the anemic pigs take the eosin stain poorly and show a marked variation in size. There are many microcytes present. In fact, a fresh mount of blood from an anemic pig often has the appearance of containing merely fragments of cells instead of normal-sized erythrocytes. Nucleated red cells were not found to be especially numerous

TABLE V—*Blood-cell and hemoglobin content of sow's blood*

	RED BLOOD-CELLS (MILLIONS PER CU. MM.)		HEMOGLOBIN (GRAMS PER 100 CC)		WHITE BLOOD-CELLS PER CU. MM.
Sow	May 26	Nov. 27	May 26	Nov. 27	May 26
2	—	6.7*	—	13.0	—
3	—	6.4	—	12.1	—
4	6.4	—	10.2	—	19000
5	—	5.1*	—	11.6	—
6	5.2	6.6	8.4	11.3	27000
7	5.2	7.3*	9.9	12.3	15000
9	6.8	—	11.7	—	22000
10	5.2	—	8.9	—	23000
11	6.0	7.3	11.0	12.3	23000
13	5.6	—	9.6	—	20000
14	5.6	—	11.0	—	17000
15	5.6	5.3	10.1	11.0	25000
20	5.6	—	10.1	—	15000
Average	5.7	6.4	10.1	11.9	20600

*Sows 2, 5 and 7 were kept inside for one year previous to the blood examinations on November 27, 1925.

Note: All sows used in these experiments were Duroc Jerseys. The boar used during 1925 was a Poland China. The boars used during the other two experiments were Duroc Jerseys.

in the blood of anemic pigs. On the other hand, normoblasts were seen now and then in the blood of pigs having more than 5,000,000 red blood-cells per cu. mm.

Counts of white cells in the blood of 23 anemic and 75 non-anemic pigs, from three to six weeks of age, showed a variation of white cells ranging from 9000 to 40,000 per cu. mm. The average number of white cells in the anemic pigs was 19,000; in the non-anemic pigs it was 20,000 per cu. mm. Differential counts showed that there were wide variations in the proportions of the various types of white cells in the blood of different pigs. However, no particular type of variation was noted as

being associated with anemia. The sows in these experiments did not show any suggestion of anemia at any time. The results of blood examinations of the sows are shown in table V.

Discussion

Table VI shows the relative prevalence of anemia in pigs under inside and outside conditions. This table also shows the comparative death-rate in pigs between one and eight weeks of age under inside and outside conditions. In each of the three experiments, anemia was much more prevalent, and the death-rate was considerably higher under inside conditions than under outside conditions. The recorded death-rate in the inside pigs during the fall of 1925 is somewhat misleading, owing to the fact that several of the anemic pigs were killed for pathologic examination and were not recorded as having died. There is no doubt that some of these pigs would have died had the anemia been allowed to run its course.

Table VI—*Death-rate and prevalence of anemia under inside and outside conditions*

When Farrowed	Where Kept	Number of Pigs Studied	Number Anemic	Per Cent Anemic	Death-rate Between One and Eight Weeks of Age (%)
Mar. 21 to Apr. 17, 1925	Inside	80	35	40.3	18.0
	Outside	42	2	4.7	11.0
Oct. 8 to Oct. 19, 1925	Inside	22	12	54.5	28.0
	Outside	39	11	28.2	23.0
Mar. 20 to May 13, 1926	Inside	44	28	63.6	64.0
	Outside	50	5	10.0	0.0
Totals	Inside	146	75	51.3	38.0
	Outside	131	18	13.7	10.6

With the exception of the experiment made during the fall of 1925, anemia was at least six times as prevalent in pigs kept inside as it was in those kept outside. On summarizing the results of three experiments, it is seen that the incidence of anemia and the death-rate were almost four times as great in the pigs kept inside as in the pigs kept outside.

Table VII shows a comparison between the death-rate in anemic and non-anemic pigs between the ages of one and eight weeks. This table shows a striking correlation between anemia and high death-rate. Without exception, the death-rate was many

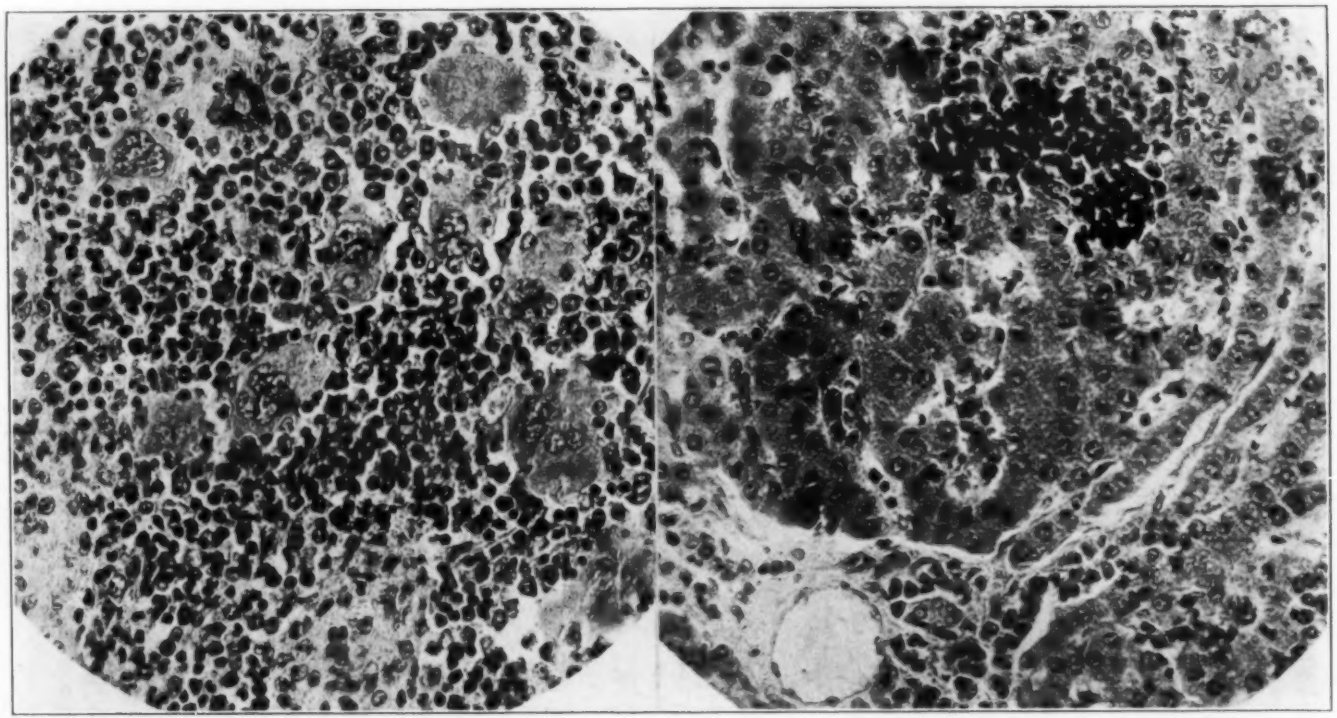

FIG. 10. Photomicrograph of a section of spleen from an anemic pig. It shows several endothelial giant-cells and numerous erythroblasts.

FIG. 11. Photomicrograph of a section of liver from an anemic pig. It shows one large and two smaller hematopoietic centers and several scattered erythroblasts.

times higher in the anemic than in the non-anemic pigs. Eighty-nine per cent of the pigs which died were anemic. It is obvious that, if anemia had been prevented, the death loss in these experiments would have been less than what is ordinarily experienced by successful swine-breeders.

Table III shows a comparison between the red cell and hemoglobin content of the blood of pigs kept inside and the red cell and hemoglobin content of the blood of litter mates which were put outside each day when the weather was favorable and given access to bluegrass. It is seen that, when the pigs were 26 days old, there was not a great difference in the number of red cells in the blood of the two groups. However, the hemoglobin content of the blood of the group kept inside was 38 per cent less than the hemoglobin content of the blood of the group which was put outside.

TABLE VII—*Relation between anemia and death-rate*

WHEN FARROWED	CONDITION OF PIGS	NUMBER OF PIGS	NUMBER DIED	DEATH-RATE BETWEEN ONE AND EIGHT WEEKS OF AGE (%)
Mar. 21 to Apr. 17, 1925	Anemic	37	17	46.0
	Non-anemic	85	2	2.3
Oct. 8 to Oct. 19, 1925	Anemic	23	15	65.2
	Non-anemic	38	1	2.6
Mar. 20 to May 13, 1926	Anemic	33	24	72.7
	Non-anemic	61	4	6.5
Totals	Anemic	93	56	60.5
	Non-anemic	184	7	3.8

Table IV shows a similar comparison between pigs kept inside and litter mates which were put outside in dry lot, without access to grass or other green feed. Here, again, it is seen that, at the end of 35 days, there was not much difference in the red cell counts of the two groups of pigs. The outside pigs, however, showed an advantage over the inside pigs as regards the hemoglobin content of the blood. It is well to mention again that one litter was five days and another was 19 days old, and already anemic, when this experiment was begun.

Figure 1 shows the comparison between the red cell and hemoglobin content of the blood of anemic and non-anemic pigs. The curves show that in the blood of non-anemic pigs, 16 days or more of age, there was a rapid increase of red cells and hemo-

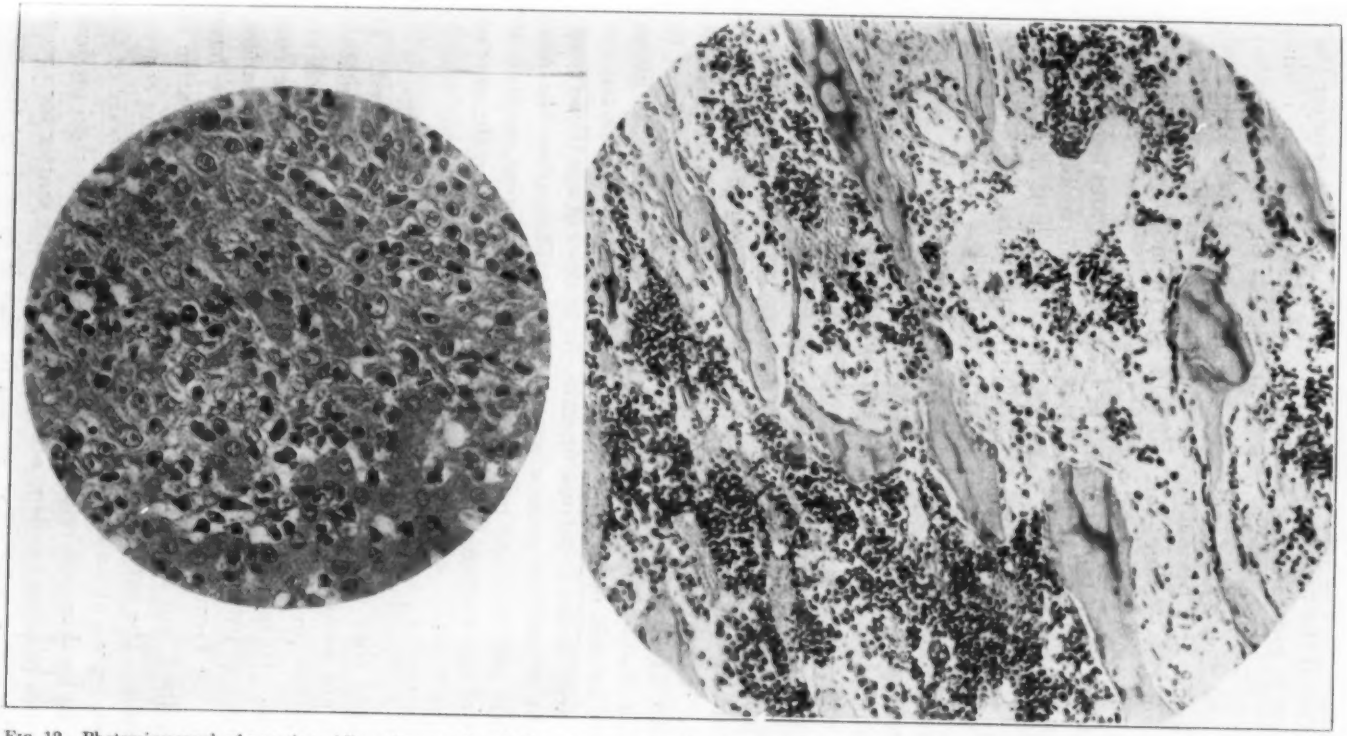

FIG. 12. Photomicrograph of a section of liver from a pig which had recovered from anemia so far as the blood picture was concerned. It shows a band of young connective tissue and several erythroblasts.

FIG. 13. Photomicrograph of a section of bone from an anemic pig. It shows clumps of erythroblastic cells. The most of the cells present are erythroblasts.

globin until the pigs were about 47 days of age. Thereafter the increase in red cells and hemoglobin was less rapid than it was previously. The increase of hemoglobin was slightly more rapid than the increase of red cells. The curves representing red blood-cells and hemoglobin in the blood of anemic pigs show that, on the average, the red cells and hemoglobin decreased until the animals were about 47 days of age. After 47 days of age, there was a rapid increase of both red cells and hemoglobin in the pigs which survived the anemia. The hemoglobin increased more rapidly than the red blood-cells. At about 95 days of age, the red cell and hemoglobin content of the blood of the anemic pigs had become about the same as that of the non-anemic. It is important to note that this recovery from anemia occurred without any change in the experimental conditions or in the rations. It is obvious, then, that this tendency to spontaneous recovery from anemia must be kept in mind in evaluating the effect of any agent which is used for therapeutic purposes.

Figure 2 shows a comparison between the average weights of anemic and non-anemic pigs between the ages of five and 95 days. It is interesting to note that the pigs which were heaviest at five days of age were usually found to be anemic later. In fact, a study of individual weight records showed that, in litters where anemia occurred, the heaviest individuals at five days of age rarely failed to become anemic. At 18 days of age the average weight of the two groups was the same. Thereafter, the non-anemic gained more rapidly than the anemic pigs, and at 98 days of age averaged 15 pounds more per head than the anemic pigs.

In considering the pathologic findings in anemic pigs, it is realized that these findings may be variously interpreted. It does not seem that any purpose would be served by speculating as to the precise cause of the degenerative changes which are found. In fact these degenerative changes can hardly be considered as pathognomonic of anemia. The proliferative changes, i. e., the formation of hematopoietic centers, such as we have described, can more safely be considered as truly indicative of anemia. The extensive formation of these blood-forming centers must represent an unusual effort on the part of the body of the pig to produce red cells. Just exactly why this effort to produce normal red blood-cells is unsuccessful, is still a matter for speculation. The belief that anemia in pigs is caused by the mere

lack of iron in the ration is far from being well supported by experimental evidence.

In regard to the role of iron in blood-formation, there are two main opinions held. One opinion is that iron must be in an "available" form before an animal can use it in forming red blood-cells. The other opinion is that there is an accessory factor which enables the animal to metabolize iron which would otherwise be unavailable. Whatever may be the correct explanation for the inability of the pig to produce red blood-cells that are quantitatively and qualitatively normal, the mere addition of ordinary compounds of iron to the common rations does not appear to give much promise of being able to prevent anemia.

Summary

During the studies reported here, anemia in pigs occurred as a striking pathologic manifestation. The conspicuous gross lesions were grayish-yellow mottling of the liver, ascites, and marked dilatation of the heart. Microscopically, the most prominent changes were marked degenerative fatty infiltration of the liver; and the presence of hematopoietic centers in the liver, spleen and bone.

In three experiments, in which the incidence of anemia under inside conditions was compared with the incidence of anemia under outside conditions, there were 277 pigs which reached one week of age; 146 were kept under inside conditions; and 131 were kept under outside conditions. Anemia was almost four times as prevalent, and the death-rate, between the ages of one and eight weeks, was nearly four times as high under inside conditions as under outside conditions. The death-rate in anemic pigs between one and eight weeks of age was almost twenty times as high as the death-rate in non-anemic pigs. Eighty-nine per cent of the pigs which died were anemic.

In two experiments in which litters of pigs were divided and one portion was kept inside and another portion was put outside, the outside pigs showed a slightly higher average red-cell count and a considerably higher hemoglobin content of the blood than the inside pigs did.

Pigs very rarely became anemic after six weeks of age. Usually a spontaneous recovery began when the affected pigs were about six to seven weeks of age.

At 98 days of age, the non-anemic pigs averaged 15 pounds more per head than the pigs which had been anemic.

The occurrence of anemia did not appear to be influenced appreciably by vitamins supplied in cod-liver oil, yeast and orange juice.

The addition of iron lactate to ration 5 did not prevent anemia in pigs kept under inside conditions.

There appears to be some factor in outside conditions which tends to prevent anemia.

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FOOD INSPECTION PRAISED

Hon. Frederick Gillmore, mayor of Utica, N. Y., paid the following tribute to the work of a well-known veterinarian, in his annual message to the Common Council of Utica, December 21, 1927:

> The work of food inspection has progressed under the guidance of the City Veterinarian, and this is another phase of health work which has brought the name of Utica to the foreground in various sections of the country. The plan of insisting upon most vigorous inspection of all places where food is offered for sale to the public has been adhered to, with the result that we are free from undesirable, unsanitary and unclean eating places, which is bound to make for a better and healthier community. Dr. Hollingworth has been a tireless worker in his desire to provide Utica with the best possible inspection of meat and other food stuff and the effect of his work is felt throughout the City.
>
> Keep up the good work, Dr. Hollingworth.

PHILADELPHIA CONVENTION NOTE

The B. A. I. official family at Washington was represented by Drs. W. E. Cotton, M. Dorset, Maurice C. Hall, U. G. Houck, John R. Mohler, E. W. Price, H. W. Schoening and A. E. Wight. Other District of Columbia members present included Dr. B. T. Woodward, of the Food, Drug and Insecticide Administration; Dr. F. W. Miller, of the Bureau of Dairying; Col. W. Geo. Turner and Lt. Col. R. C. Musser, of the U. S. Army; Drs. John P. Turner, W. S. Gochenour and H. A. Locke.

Sciences (even when they are right taken) can teach us nothing but wisdom, honesty, integrity and resolution. —*Montaigne.*

ACIDOSIS OF PREGNANT EWES: SO-CALLED PREGNANCY DISEASE OF SHEEP*

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For the past few years sheep-breeders throughout Kentucky, and especially in the Blue Grass region, have experienced severe losses of pregnant ewes during the last months of pregnancy. A similar disease has been observed in different parts of the United States, and in European countries.

The disease occurs during the months of January and February, a few weeks previous to lambing, and may continue throughout the lambing period. The cause of the disease is not known. Heavy feeding and lack of exercise were considered factors in causing the disease in North Dakota.[1] Observers in Colorado[2] were satisfied that a bipolar microbe caused the disease but other observers, including ourselves, failed to corroborate this. Murillo and Izcara[3] consider the disease an infectious inflammation of the bile-ducts and gall-bladder, and Czako and Hartman describe a similar disease with no fever and following a benign course. In Europe the disease is known as acute diffuse parenchymatous hepatitis,[5] while in this country it is generally known as pregnancy disease of sheep.

The disease is apparently non-infectious and non-contagious as repeated attempts made at this Station[4] failed to transmit the disease, or to isolate a causative microbe. While feeding may be an important factor we have been unable to demonstrate that the disease is caused by any particular feed or method of feeding. The greatest losses have occurred in flocks fed a heavy grain ration, especially one containing considerable corn but no alfalfa or clover. Many farmers report that the disease appears a day or two after salting. In certain flocks the disease has caused a loss of from ten to twenty-five per cent of ewes.

Symptoms

The first noticeable evidence of so-called pregnancy disease in ewes is that the ewe lags behind the rest of the flock, or if the flock is confined in a stable the ewe is observed to be standing

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off by herself and does not come up to eat. As the disease progresses there is evidence of nervousness and irritability, grinding of the teeth, tendency to walk in a circle or stand with the head pressed against some object in the pen. The eyesight is affected only partially, at first, but later the ewe in many cases is apparently blind. As the disease progresses the animal is found lying down more or less constantly and gradually becomes indifferent to her surroundings. Still later the animal is unable to arise without assistance. Finally the animal passes into almost complete coma, many of them having at irregular intervals or, when disturbed, convulsions or spasms.

At first the head may be resting naturally on the ground or turned towards the body, later the head is protruded and often drawn backward. Frothy discharge may be observed from both the mouth and nostrils and the respiratory movements are somewhat accelerated. The temperature remains normal throughout the course of the disease. The duration of the disease may be several days, even after complete coma develops. According to our observations the ewes affected with this condition are more apt to be constipated than to suffer from diarrhea, especially in the beginning. They are unable to take food but apparently are thirsty, as many will attempt to drink if given an opportunity. The lambs have always been found alive in ewes killed in an advanced stage of the disease. Clinical examination of the genital tract shows that the cervix is closed and sealed normally and has no tendency to dilate and facilitate the delivery of the lamb. In a few cases when the ewe has given birth to the lamb or lambs that were alive and apparently healthy, the ewe immediately showed improvement and in a few hours was up and apparently normal. In one case dilation of the cervix was successful and the lambs were delivered. The lambs were dead but the ewe immediately showed improvement and recovered without further incident. In numerous cases, however, it was exceedingly difficult to cause premature birth. It is assumed, in the sick sheep that delivered their lambs without assistance and in those cases where forced delivery was used, that they represent full-term pregnancy.

Pathology

The findings on postmortem examination have in every case failed to reveal lesions or tissue changes that in any way explain the nature of the trouble. With sheep that were killed, except

in the last stage of the disease, the blood was apparently normal, and in those that died the blood on postmortem was not greatly different in its gross appearance from normal blood. In some cases antemortem coagulation was indicated, as on attempting to make intravenous injections, or to draw blood from ewes in an advanced form of the disease, there was great difficulty in dilating the jugular vein or in drawing blood through a 16-gauge hypodermic needle. No changes whatever have been observed in the reproductive organs. Distinct inflammatory changes were not constant and when present probably did not constitute a part of the disease. The kidneys show congestion and are uniformly dark red in color and frequently pulpy in consistency. The liver is enlarged, friable and of a lighter brown color than normal, often mottled. This organ most frequently shows evidence of pathological change on postmortem examination. The gall-bladder is usually distended with a thick brownish-green bile. We have never observed occlusion of the bile-duct. The mottling of the liver is apparently due, in part, to the bile pigments and in part to degenerative changes. Small hemorrhages are found in most cases on the heart that in size and distribution resemble those found in cases of septicemia and toxemia.

Microscopic Examinations

Microscopically the kidneys show congestion, hemorrhage and acute cellular degeneration. Sections of the liver show congestion, hemorrhage and degeneration that in some instances approaches focal necrosis. Other organs of the body are apparently not consistently involved in any type of pathological changes, either gross or microscopic.

Bacteriological Examinations

Bacteriological examinations repeatedly made from animals that had died or that were killed in an advanced stage of the disease showed negative results. Animal inoculations, including sheep, rabbits, guinea pigs and mice, have proved negative.

In a study[5] of the urine of forty normal ewes, twenty-nine of which were pregnant, eight barren, while with three the pregnancy was doubtful, the normal chemical urinalysis was determined as follows:

Color, yellow; condition, clear, no precipitate; specific gravity, 1031; reaction, alkaline; urea, 2.5 per cent; ammonia, 0.01 per

cent; total nitrogen, 1.4 per cent; no sugar, no albumen and no acetone.

During the lambing season of 1927 eleven cases of the so-called pregnancy disease of sheep were observed. The urinalyses in these cases were as follows:

Case 1: No. 6988: Yellow, cloudy, no precipitate; specific gravity, 1076; strongly alkaline; urea, 3.53 per cent; ammonia, 0.15 per cent; total nitrogen, 1.63 per cent; no sugar; acetone, 1 per cent and marked albumen.

Case 2: No. 6995: Yellow, cloudy, precipitate; specific gravity, 1020; acid; urea, 1.32 per cent; ammonia, 0.10 per cent; total nitrogen, 0.95 per cent; no sugar; acetone, 1 per cent and marked albumen.

Case 3: No. 6997: Yellow, cloudy, precipitate; specific gravity, 1020; acid; urea, 1.56 per cent; ammonia, 0.16 per cent; total nitrogen, 1.25 per cent; no sugar; acetone, 1 per cent; marked albumen.

Case 4: No. 7008: Yellow, cloudy, heavy precipitate; specific gravity, 1027; markedly acid; urea, 0.33 per cent; ammonia, 0.1 per cent; total nitrogen, 0.85 per cent; no sugar; acetone, 1 per cent plus; very heavy albumen.

Case 5: No. 1: Yellow, clear, slight precipitate; specific gravity, 1012; acid; urea, 1.4 per cent; ammonia, 0.08 per cent; total nitrogen, 0.87 per cent; no sugar; acetone, 1 per cent; marked albumen. This case recovered and later suffered a relapse during which the ammonia in the urine increased to 0.17 per cent and the animal died.

Case 6: No. 2: Yellow, clear, slight precipitate; specific gravity, 1040; acid; urea, 2.15 per cent; ammonia, 0.15 per cent; total nitrogen, 1.4 per cent; no sugar; acetone, 1 per cent plus and marked albumen.

Case 7: No. 3: Yellow, clear, slight precipitate; specific gravity, 1009; markedly acid; urea, 0.86 per cent; ammonia, 0.11 per cent; total nitrogen, 0.51 per cent; no sugar; acetone, 1 per cent plus and a trace of albumen.

Case 8: No. 4: Yellow, clear, slight precipitate; specific gravity, 1010; markedly acid; urea, 1.14 per cent; ammonia, 0.18 per cent; total nitrogen, 0.73 per cent; no sugar; acetone, 1 per cent plus and a trace of albumen.

Case 9: No. 5: Slightly acid; ammonia, 0.15 per cent; acetone, 1 per cent plus and a trace of albumen.

Case 10: No. 7: Acid; ammonia, 0.09 per cent; acetone, 1 per cent plus and a trace of albumen.

Case 11: No. 1 (Horlacher): Markedly acid; ammonia, 0.15 per cent; acetone, 1 per cent plus; no sugar; albumen present.

The above eleven cases of so-called pregnancy disease died. The urinalyses in these cases differed from the normal urinalysis in the reaction, which, with one exception, was acid or markedly acid; in showing a precipitate; in the quantity of ammonia which was increased from eight to fifteen times the normal quantity; in the presence of acetone and in the presence of albumen. Cases 5 and 11 are of interest in that the former during the first attack showed only 0.08 per cent ammonia which, during the second and fatal attack, rose to 0.17 per cent; while the latter case was the first to occur in the Station flock during a number of years and promptly followed a change from the usual feed to soybean hay. The urine of four normal ewes with normal lambing showed no sugar, no acetone, no albumen and the following percentages of ammonia: 0.03; 0.02; 0.01; 0.18.

The urinalyses of these eleven cases of so-called pregnancy disease strongly suggested an acidosis and therefore in three cases the unrinalyses were checked by examinations of the blood.

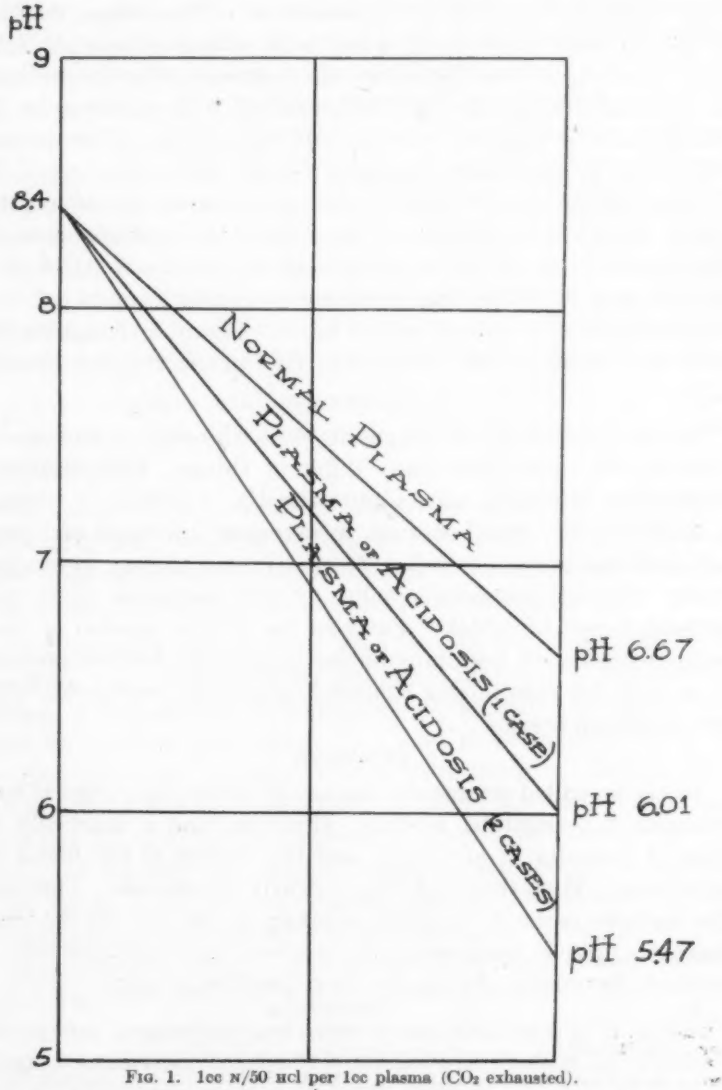

Fig. 1. 1cc N/50 HCl per 1cc plasma (CO_2 exhausted).

Cullen[6] has shown that the addition of an equal volume of N/50 HCl to normal blood-plasma, from which the CO_2 has been exhausted, causes a relatively small increase in acidity,

due to the presence of buffers in the plasma, whereas in cases of acidosis, where the buffers of the blood are exhausted, the increase in acidity is marked.

Using Cullen's method,[7] the plasma of twelve normal sheep was examined and the increased acidity on the addition of an equal volume of N/50 HCl was measured. The average reaction of plasma from which the CO_2 had been exhausted was pH 8.40; while the average reaction of the same plasma, after the addition of an equal volume of N/50 HCl, was pH 6.67, showing an increased acidity equal to 1.63 of a pH value. (It will be remembered that as the acidity increases the pH value decreases.)

Upon examining the blood of the three cases of so-called pregnancy disease, the addition of the HCl to the plasma increased the acidity from pH 8.4 to pH 6.01 in case 5, and to pH 5.47 in cases 6 and 7. Thus the condition is clearly an acidosis with exhaustion of the buffers of the blood. Figure 1 illustrates the increased acidity on the addition of HCl to the CO_2-free plasma.

TREATMENT

In the treatment of pregnant ewes showing symptoms of acidosis, we have tried many different things. Comparatively large doses of Epsom salt, administered as a drench or through a stomach-tube; rectal enemas; intravenous injections of Epsom salt, calcium lactate, bicarbonate of soda and glucose were apparently without beneficial results. Udder inflations were tried without beneficial results. Early in the work a number of cases were treated with botulinus antitoxin and the various preparations used for immunizing against hemorrhagic septicemia without beneficial results.

SUMMARY

In the so-called pregnancy disease of sheep, the urine is acid, contains a precipitate, acetone, albumen, and a markedly increased quantity of ammonia, and the buffers of the blood are exhausted. Thus the condition is clearly an acidosis. Therefore the authors name it "acidosis of pregnant ewes." As the treatment to date is unsatisfactory, methods of treatment will be studied thoroughly during the next lambing season.

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POST-VACCINATION TROUBLES AND THEIR PREVENTION*

By W. H. LANE, *Camden, Indiana*

Most post-vaccination troubles are really caused by pre-vaccination trouble. For the most part, causes which determine serum failures have been in operation some time before the date of vaccination and their presence could have been detected by experienced men. In more exceptional instances the approach of danger cannot be foretold and occasionally disaster follows, and it often takes years of most successful vaccination to overcome the skepticism caused by one vaccination break in a neighborhood. The swine-breeder may feel that he must choose whether to pay the cost of vaccination and perhaps have cholera artificially introduced into his herd by a vaccination break, or save the vaccination bill and risk natural infection.

A "vaccination break" is an unexpected attack of hog cholera subsequent to the administration of the simultaneous vaccination treatment.

The practitioner's responsibilities are complex. He must prevent breaks and do it as cheaply as possible. Before we consider some of the more specific causes of serum failures, it seems well to emphasize one or more governing principles.

The qualified veterinarian who accepts the responsibility of handling hog cholera should do more than use a hypodermic syringe. The element of judgment is essential, and this in turn rests on training and experience. And these qualities must be supplemented by habitual carefulness, both in making herd examinations and in vaccination technic. We cannot look too carefully for sickness in a herd nor inquire too closely into the history of the herd and the farm when we are about to vaccinate if we would avoid post-vaccination troubles. We should caution the owner as to the limitations of serum and virus for the prevention of hog cholera, and point out to him that cholera vaccination is neither a cure nor a preventive for any other hog disease. Too many hog-owners grow careless, once their herds are vaccinated, expecting that the treatment will "ward off all approaching danger" in the way of all other diseases.

*Read at the annual meeting of Tippecanoe Veterinary Medical Association, Lafayette, Indiana, September 6, 1927.

As soon as cholera is diagnosed, neighbors should be notified of the existing danger and advised to vaccinate and use every precaution against distributing the disease through visiting cholera-infected lots and in other ways.

Preparation of Swine for Vaccination

In preparing swine for vaccination I would advise against any radical change in the kind of feeds being given, unless they were causing intestinal disturbance, in which case I would advise that the feeding be changed to correct the disturbance before vaccination, if possible. However, you all know that it is impossible and impracticable to waste time in trying to correct methods of feeding when you have cholera infection present, and must resort to vaccination as soon as possible, and that is not always soon enough. I would, if it were possible, reduce the amount of the ration, especially in those animals which are being heavily fed for growth or market. I now advise feeding only a maintenance ration for the first two weeks following vaccination, with an increase to full feed during the third week if no trouble has appeared.

Our clients do not like this idea of seeing their hogs at a standstill, for a couple of weeks, but it seems to me I am rendering better service by so advising them and thus preventing troubles due to the above cause. It seems also that by faulty or heavy feeding one may get breaks which do not occur otherwise.

Factors Responsible for Post-Vaccination Troubles

Post-vaccination troubles may be divided into two classes: first, that which occurs during the first three or four weeks following vaccination, the so-called "serum break"; second, that which appears subsequent to the fourth week following vaccination, the "virus break." Among more common causes of "serum breaks" are: heavy parasitic infestation, particularly with ascarids and lung worms; necrotic enteritis; various pulmonary disorders; the so-called hog "flu"; weaning; castrating; exposure to inclement weather during the reaction period; injudicious feeding; and hog cholera in the incubation period at the time of vaccination. If these conditions are ignored, sooner or later they will take their toll, and serve to spread hog cholera and to break down confidence in vaccination.

Serum Breaks

Potency of the serum used is, of course, an important factor in relation to serum breaks, but we as practitioners are not able

to judge the efficacy of the product in advance of its use. Sufficient increase in dosage of serum is always indicated when hogs known to be slightly below normal in resistance are to be vaccinated. Every individual presented for treatment means a decision on dosage. There are two important factors which should influence dosage: first, the weight of the animal; second, the physical condition. The weight should be estimated liberally. If in doubt one should always figure on a high estimate rather than a low one. An animal in poor physical condition calls for an increase in dosage. Unthrifty animals will withstand the treatment much better if the dosage of serum is sufficiently increased. If a pig is of the unthrifty kind, especially if it is infested with worms, a difference of ten or fifteen cubic centimeters of serum may mean the difference between saving or losing the pig. But a little extra serum is in no way a safe substitute for care and skill in detecting devitalizing influences in a herd.

Virus Breaks

Virus breaks or hog cholera which appears in from one to several months after treatment, sometimes cause very heavy losses, for the supposedly immune hogs die as they approach maturity, at a time when they are of considerable value. Virus breaks are caused by inert or insufficient dosage of virus. At any rate, so far as the virus is concerned, the veterinarian who uses due care in preserving and administering it does all within his power to establish permanent immunity in the pigs he vaccinates. Virus breaks have sometimes been associated with baby-pig vaccination. Although relatively rare in pigs treated while quite young, nevertheless, it does sometimes occur. Therefore, I would hesitate to advise it as a routine measure in the field, as the breeder's confidence in such a product as cholera serum is well worth preserving.

Necrotic Enteritis

Necrotic-enteritis or "pig typhoid" has been quite prevalent in our section of the State this year. No doubt, intestinal parasites and insanitary conditions are predisposing factors in connection with this disease. Contaminated feed or water taken into the digestive tract is the usual source of infection. Sanitary requirements are frequently ignored by the hog-feeder and breeder. Here, the practitioner can render a helpful service by offering suggestions in the way of sanitation.

All of the above influences may operate singly or in combination and, perhaps, some of them may be ignored repeatedly without disaster. But sooner or later they will take their toll, and serve to spread hog cholera and to break down confidence in vaccination. The veterinarian who does not make an honest effort to find the true cause of a vaccination break, and inform the owner of it, is not worthy of his patronage. He is false to the man who is paying him for his services and deserves to lose his client.

EXAMINATIONS FOR VETERINARY SANITARIANS

The United States Civil Service Commission announces open competitive examinations for junior veterinary sanitarian (dairy) and assistant veterinary sanitarian (dairy). Applications for examinations must be on file with the Civil Service Commission not later than January 28, 1928. The date for assembling of competitors will be stated on their admission cards and will be about ten days after the close of the receipt of applications.

The salary of junior veterinary sanitarian will be between $1,860 and $2,400, and the salary of assistant veterinary sanitarian between $2,400 and $3,000, depending upon the conditions obtaining at the headquarters where each vacancy exists. A probationary period of six months is required; advancement after that depends upon individual efficiency, increased usefulness, and the occurrence of vacancies in higher positions.

The duties include the examination of dairy cattle to determine their freedom from disease; the inspection or examination of milk and cream; the inspection of milk-producing and handling plants with special reference to sanitation in the enforcement of the Federal Import Milk Act; and to perform related work as assigned.

Appointees are required to perform field services during a considerable portion of the year. When on such field duty, the necessary traveling expenses will be borne by the Department, and actual subsistence, or per diem in lieu thereof, will be allowed.

Competitors will be rated on milk hygiene, dairy and milk-plant sanitation, theory and practice of veterinary medicine, pathology, training and experience.

Full information may be obtained from the United States Civil Service Commission at Washington, D. C., or the secretary of the United States civil service board of examiners at the post office or customhouse in any city.

CLINICAL AND CASE REPORTS

(Practitioners and others are invited to contribute to this department reports of unusual and interesting cases which may be helpful to others in the profession.)

ASCITES IN THE DOG

By A. A. Feist, *St. Paul, Minn.*

This report covers what I believe to be a new treatment, although not necessarily a cure, for ascites, or dropsy, in the dog. We know that dropsical conditions are found in old animals quite frequently and are most often due to chronic indurative nephritis or cirrhosis of the liver. In most cases of disordered kidney function, the physician or veterinarian prescribes plenty of water to drink, for the purpose of flushing the kidneys.

Recently I had three cases of ascites. One case was a dog thirteen years old. The abdomen was distended with fluid, breathing was distressed and the dog drank about a gallon of water per day. I did not aspirate the fluid, but put the patient on a diet of vegetables, fish and milk. I prescribed a diuretic and a heart stimulant. The mucous membranes of the mouth were very anemic.

The patient was brought back ten days later, very much worse. The owner claimed the dog did nothing but drink water. An idea then flashed through my mind. If the kidneys were not functioning and could take care of only a certain amount of fluids, why not try to eliminate liquids from the diet? This is the point in which I am interested. I cut this dog down to two glasses of water per day and ordered him brought back in ten days. I also put him on an antacid tablet of bismuth and soda, to eliminate what I thought was a burning stomach. This particular animal has improved 100 per cent, is back to normal and feels like a new dog. I would like to have some of my fellow practitioners try this line of treatment and later report their observations and results.

Treatment

1. Diet: Fish, milk (alternately with water) and vegetables, boiled. Water, one-half glass twice daily.

2. Medication. One tablet containing the following, daily:

Sodium bicarbonate	5 gr.
Magnesium carbonate	5 gr.
Bismuth subnitrate	5 gr.

For flushing the urinary tract we use a tablet containing urotropin, lithium carbonate, methylene blue, corn silk and couch grass, one tablet twice daily. The point I wish to stress is that, when an organ like the kidney or liver is getting to an indurated stage, it is well to save the functioning power by cutting down on the liquids.

In the first stages stop all fluids and do not aspirate. Give from one-half to one ounce of water three times daily. My idea is to use the dropsical fluid through reabsorption, if such a thing is possible. So far I have observed, in three or four cases, that aspirating is not necessary when fluids are withheld.

OHIO SHERIFFS MUST ASSIST VETERINARIANS

Some veterinarians in Ohio engaged in tuberculosis eradication work have been meeting with stiff opposition and they have asked local sheriffs to protect them from bodily injuries in several cases, where violence was threatened. Some sheriffs have refused to give the veterinarians the protection asked. Whereupon the State Director of Agriculture, Mr. Charles V. Truax, asked the Attorney-General, Mr. Edward C. Turner, for a ruling. The latter has given his opinion to the effect that it is the duty of sheriffs and their deputies to accompany agents of the State Department of Agriculture when there are signs of trouble and that it is not necessary for them to wait until an actual assault has been committed or other violence done.

KEYSTONE VETERINARY MEDICAL ASSOCIATION

The annual meeting of the Keystone Veterinary Medical Association was held at the University of Pennsylvania Veterinary School, Philadelphia, October 26, 1927. Officers for the year were elected as follows: President, Dr. W. H. Ivens, Philadelphia; secretary-treasurer, Dr. C. S. Rockwell, Philadelphia; board of directors, Dr. G. A. Dick, Dr. E. L. Stubbs and Dr. E. T. Booth, Philadelphia; Dr. Joseph W. Vansant, Fox Chase, and Dr. Walter G. White, Lansdowne.

This meeting marked the twelfth time that Dr. Rockwell has been elected secretary-treasurer of the organization.

G. A. D.

REVIEWS

KENNEL BUILDING AND PLANS. Will Judy. 29 pages. Illustrated. Judy Publishing Co., Chicago, Ill., 1927. Price, $1.00.

A brief but comprehensive booklet, in ten chapters, on how to locate, plan, build, ventilate and heat dog kennels, large and small. Well illustrated with photographs and drawings.

TOPOGRAPHICAL ANATOMY OF THE DOG. O. Charnock Bradley, M.D., D.Sc., M.R.C.V.S., Principal, Royal (Dick) Veterinary College, Edinburgh, and Lecturer on Comparative Anatomy, University of Edinburgh. Second edition. 257 pages. 80 illustrations. Oliver & Boyd, Edinburgh and London, 1927. Price, 24/- net.

The second edition of this book supersedes the author's classbook under the title, "Notes on the Dissection of the Dog." The present edition has been altered and revised to a marked degree and a number of illustrations have been added. While the subject is essentially topographical, the work is not by any means neglected, either in text or in illustration. In his second edition it is the author's aim to give to the veterinary student and the student of comparative anatomy a textbook which provides him with a clear, concise and methodical dissection guide. Being cognizant of the intense interest manifested today in canine medicine and surgery, it is also the author's aim, particularly in this edition, to furnish a book of reference for the canine practitioner. The present-day need of a work of this kind for teachers of veterinary and comparative anatomy, for students and for the canine practitioner, contributes to make the appearance of this new edition very timely.

W. J. L.

ABSTRACT

STERILIZATION OF LOCAL AND GENERAL INFECTIONS BY INTRAVENOUS INJECTION OF MERCUROCHROME.* Hugh H. Young, Johns Hopkins Hospital, Baltimore, Md.

A brief review of the researches that led to the development of mercurochrome was given, also a description of the properties

*Abstract of an address before the Philadelphia County Medical Society, September 25, 1927.

of the compound. Slides were shown demonstrating that the therapeutic factor of mercurochrome against staphylococci, *B. coli communis* and the gonococcus is greater than most drugs. In a study of the elimination of mercurochrome in man, it was found in the stools in strength 1:10,000, from the fourth to the thirteenth hour after injection; in the urine, in 1:15,000 the first hour, 1:25,000 the second hour, 1:10,000 up to the sixth hour; in the vomitus for the first three hours in 1:100,000 dilution.

In a series of 173 cases of septicemias of all types, of 16 cases of genito-urinary origin, 72.7 per cent were cures; of 8 traumatic cases, 67.7 per cent cures; of 6 traceable to the throat, 75 per cent cures; of 11 originating in ears and sinuses, 87.6 per cent cures; of 7 osteomyelitic cases, 70 per cent cures; of 4 endocarditis, 22 per cent cures; of the total studied, 68. 2 per cent survived.

In a series of twenty-four cases of septicemia that recovered, there were found *B. coli*, *Staphylococcus aureus*, *Staphylococcus albus*, *Streptococcus viridans*, *S. hemolyticus*, pneumococcus and diplococcus and the beneficial results were obtained in some cases by single large doses, in others by multiple small ones. Dr. Young also stated that the compound was now being used with considerable success in bronchopneumonia and cited the work of Freeman and Hoffe, of Atlanta, Georgia, who, in two series of cases treated with mercurochrome, reduced the mortality in one series from 36 per cent to 8.5 per cent, and in the other from 32.5 per cent to 8 per cent. Dr. Young offered experimental data showing that rabbits injected intravenously with a dose of mercurochrome equal to 5 mg. per kg. contained a sufficient amount of the compound in their lungs at the end of one hour as to be germicidal for streptococci and staphylococci. Dr. Young also stated that in lobular pneumonia, especially when due to *Streptococcus hemolyticus*, the drug is quite extraordinary in its effects.

Dr. Young emphasized the importance of intravenous injection of the drug and cited numerous case reports of its use in many conditions. He showed that wounds, experimentally produced and infected with staphylococci, responded to treatment in a shorter period when the mercurochrome was given intravenously in 7.6 days; while wounds treated locally responded in 10.7 days and the untreated in 16 days.

Dr. Young emphasized the use of mercurochrome in small repeated doses, rather than in one or two large doses. He recommended doses of 1 to 3.5 mg. per kg. body weight, repeated at

intervals of 24 to 48 hours, rather than 5 to 7.5 mg. per kg. given only once, or at least repeated once, using a one per cent solution.

Dr. Young closed by stating that over a thousand cases treated intravenously are on record, with the results confirmed from many eminent sources. In the 28 per cent of failures which occur in all types, the blood is often made inhibitive but not antiseptic. The drug is not dangerous and its action was unknown, but what he did know was that whatever happened, that something was good.

M. J. H.

PUBLICATIONS RECEIVED

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The Industrial Medicine Chest. Abbott Laboratories, North Chicago, Ill. pp. 31. Illustrated.

Michigan State College of Agriculture and Applied Science, Report of the Veterinary Division for the year ending June 30, 1926. East Lansing, Mich. pp. 39.

Ministry of Agriculture and Fisheries, Annual Report of Proceedings under the Diseases of Animals Acts for the year 1926. London, England, 1927. pp. 100.

Important Points for Each Cattle Owner Whose Herd Has Been Tuberculin Tested Under the Modified Accredited Area Plan. C. G. Jordan and T. E. Munce. Pa. Dept. of Agr., Bureau of Animal Industry, Harrisburg, Pa., 1927. pp. 8.

The Pennsylvania Dog Law. Pa. Dept. of Agr., Bureau of Animal Industry, Harrisburg, Pa., 1927. pp. 7.

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"Grass Disease" in Horses. W. A. Pool. Reprint of paper presented to the Annual Meeting, Scottish Branch, National Veterinary Medical Association of Great Britain and Ireland, October 15, 1927. pp. 26.

Annuario Veterinario Italiano 1925-1927. Alfredo Bartolucci. Dell'Instituto Sieroterapico Milanese, Milan, Italy, 1927. pp. 443.

Test for Efficiency of Various Remedies for Stomach Worms. Live Stock Sanitary Commission of Texas, Fort Worth, Texas, 1927. pp. 20.

Ohio State Veterinary Medical Association, Year Book, 1927. Columbus, Ohio. pp. 127.

Surgeon General U. S. Army for the fiscal year ending June 30, 1927, Report of the. Washington, D. C., 1927. pp. 501.

Adrenalin in Medicine. Parke, Davis & Co., Detroit, Mich. pp. 29.

The Bloodless Phlebotomist. Vol. vi, 3, Denver Chemical Mfg. Co., New York, N. Y.

Bureau of Animal Industry, 1927, Report of the Chief of the. John R. Mohler. Washington, D. C. pp. 50.

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ARMY VETERINARY SERVICE

RECENT IMPORTANT DISCOVERIES AND DEVELOPMENTS BY THE ARMY VETERINARY CORPS

Certain far-reaching discoveries made by the veterinary officer on duty with the Medical Research Board, Manila, P. I., Major Raymond A. Kelser, are well worthy of a more general description than they have hitherto received.

Major Kelser, working over a long period of time but more especially during the outbreak of surra at Fort Wm. McKinley in the summer of 1926, has definitely determined that the fly known as *Tabanus striatus* is the chief insect involved in the transmission of surra, a fatal disease of solipeds of the tropics. In making this discovery, it was determined that the transmission

MAJOR R. A. KELSER

was purely mechanical and that no part of the life cycle of the trypanosome was passed in the fly. These findings are of special importance since the main carrier being known it is only necessary to avoid its breeding places and to take all possible precaution to keep down the number of insects, in order to reduce greatly the incidence of the disease. The economic value to the Philippine Islands and other tropical countries of this discovery, as well as its extreme importance to the Army, is only too apparent.

Another, and more important, discovery of this officer, is a new and quicker method of preparing a reliable rinderpest

vaccine. By the old methods several weeks were required for preparation, and then the product was so unstable and uncertain that it could be kept in stock only a short time. A laboratory procedure has been worked out whereby rinderpest vaccine is prepared by the attenuation of the virus with chloroform in a few days and exhaustive tests indicate that it is highly efficient and will keep for many weeks under the usual conditions attending the care of biologics.

The economic importance of this discovery is incalculable, since the wealth of a large percentage of the population of the Islands is measured by the number of carabaos possessed. Any highly infectious and contagious disease which will sweep rapidly through such a country, resulting in a high rate of mortality among the animals of chief economic value, is little less than a national disaster.

The following figures give some indication of the importance of rinderpest:

Year	*Number of animals affected*	*Deaths*
1921	45,000	35,000
1922	45,000	34,000
1923	27,000	22,000
1924	19,000	15,000
1925	15,000	Not available
1926	9,824	Not available

From the above it will be seen that approximately 106,000 head of cattle, carabaos, etc., died as a result of rinderpest. Averaging these animals at $100.00 per head, the monetary loss for the four years on which figures are available is $10,600,000. With the new vaccine a large percentage of this loss will be prevented.

A civilian publication recently stated that this discovery of Major Kelser will more than pay the entire cost of American occupation since Dewey sailed past Cavite. The late General Wood, Governor-General of the Philippine Islands, saw fit to commend Major Kelser for his work. This officer has been invited to address the Congress of the Far Eastern Association of Tropical Medicine at Calcutta, India, on his work with rinderpest vaccine.

A third and almost equally great achievement of this officer is the elaboration of a successful treatment for epizootic lymphangitis. This disease has been a scourge of equines in the Islands

and especially so amongst Army animals where it has materially advanced the sick- and death-rates and caused an enormous number of days of duty lost.

The Surgeon General's Annual Report for 1927 shows 102 cases of epizootic lymphangitis, with an average of 75 days of duty lost per case for the Philippine Department. With the new treatment, which consists of the intravenous injection of 0.5 gram mercuric iodid with 60 cc sterile water, it is possible to effect a cure in a large percentage of cases and to reduce the "days of duty lost" by some 80 to 90 per cent.

A new and important contribution to veterinary and medical literature has been brought out in the publication of a *Manual of Veterinary Bacteriology* by Major Kelser. This work has been favorably received by the press and critics in general and no doubt constitutes the last word in veterinary bacteriology, serving to bring the many new discoveries in this field up to date.

W. G. T.

CHANGES RELATIVE TO VETERINARY OFFICERS

Regular Army

Colonel Robert Vans Agnew, now on temporary duty at Fort Oglethorpe, Georgia, is relieved from further assignment and duty at Fort McPherson, Georgia, and will report to the commanding officer, Fort Oglethorpe, for duty.

The appointment of Second Lieutenant John Lloyd Owens, Veterinary Corps Reserve, as second lieutenant, Veterinary Corps, Regular Army, with rank from October 29, 1927, is announced. Lieutenant Owens will proceed from Tacoma, Washington, to San Francisco, Calif., and sail on the transport scheduled to leave that port on or about November 26, 1927, for New York City. On arrival in New York he will proceed to Carlisle Barracks, Penna., and report to the commanding officer, that station, for duty as assistant to the station veterinarian.

Major Raymond A. Kelser is assigned to duty at the Army Medical School, Army Medical Center, Washington, D. C., to take effect upon completion of his present tour of foreign service, and will join that station at the proper time, in accordance with orders to be issued by the commanding general, Philippine Department.

Captain Francois H. K. Reynolds is relieved from his present assignment and duty at the Army Medical School, Army Medical Center, Washington, D. C., to take effect at such time as will enable him to comply with this order, and will proceed at the proper time to New York City and sail on or about March 7, 1928, via Government transportation, to the Philippine Islands. Upon arrival in Manila, Captain Reynolds will report to the commanding general, Philippine Department, for assignment to duty as a member of the United States Army Medical Department Research Board.

Second Lieutenant Verne C. Hill is relieved from further assignment and duty at Fort Bliss, Texas, and will proceed to Camp Marfa, Texas, and report to the commanding officer, that post, for assignment to duty.

First Lieutenant Herbert M. Cox is relieved from further assignment and duty at Fort D. A. Russell, Wyo., and will proceed to Fort Des Moines, Iowa, and report to the commanding officer, that post, for duty.

The relief of Captain Louis L. Shock from additional duty at headquarters, District of Washington, effective as of November 12, 1927, is announced.

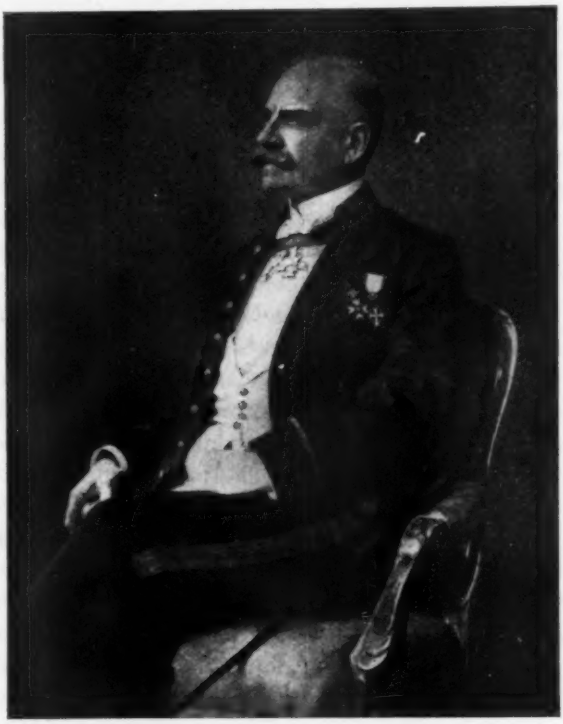
Reserve Corps

New Acceptances

Loope, Clarence Leroy.....2nd. Lt...Box 465, Cazenovia, N. Y.
Hogg, James Seely.....1st. Lt....20 Darling St., Wilkes-Barre, Pa.
Owens, John Lloyd.....2nd. Lt...c/o Carstens Pkg. Co., Tacoma, Wash.
Phillips, Ross M.....Captain..Gibbon, Nebraska.
Reid, George Forrest.....2nd. Lt...Irene, So. Dak.

Separations

Brostrom, Frank Oscar.....1st. Lt...Resigned 11-1-27.
Owens, John Lloyd.....2nd. Lt...Accepted appointment in RA 11-4-27



DR. GUSTAF KJERRULF

Dr. Kjerrulf, of Stockholm, Sweden, was elected to honorary membership in the American Veterinary Medical Association, at the recent meeting, in Philadelphia. Dr. Kjerrulf is a member of the Royal State Department of Health of Sweden and possesses many decorations bestowed by his own and foreign countries. He is editor-in-chief of *Skandinavisk Veterinartidskrift* and author of many articles on scientific subjects. The University of Upsala conferred the degree of Doctor of Medicine (*honoris causa*) on Dr. Kjerrulf in 1907.

COMMUNICATION

SHALL THE NAME VETERINARIAN BECOME PASSÉ?

To the Editor:

The writer was very much interested in and considerably amused by the editorial, "What's in a Name?" in the December Journal. He feels sure that as interest in the proposed change grows, and more members are heard from, the majority opposed to adopting a new title will become increasingly larger.

If the word "veterinarian" does signify that the holder of the title treats sick and ailing "beasts of burden," it certainly is not a misnomer. There is nothing about it to signify or indicate that we treat none but beasts of burden. Then, too, a pretty broad interpretation may be placed on "beasts of burden." Not only horses are used for carrying loads. The term "beasts of burden" should rightly include the bovine species, as there are a great many oxen in use today on the farms and around the mines, both in this country and Canada, doing the work that the urban viewpoint of some of our city-dwelling members has led them to believe was done only by the horse or some form of motive power. And how about the dog? Does he not do practically all of the transporting and lugging of grub-stakes and travelers in the Arctic regions? He also often serves as the milkman's "steed" in Holland and certain other European countries. The writer has seen a number of goats that could be hitched and driven, and how about the proverbial caprine of the ritual of most lodges, that must be ridden before prospective members become habitual motion-seconders at the lodge meetings? There is a trained rooster in vaudeville that pushes a miniature wheelbarrow. Even "Bossie," the family cow, has at times been pressed into service, and the writer recalls one particular female bovine that was habitually made to work double in harness with a gelding, and, besides pulling her share of the load, she was an asset to her owner in that he often stopped her at the roadside, sold and delivered a quart of raw, fresh milk to any comer at the current price. The elephant and the camel are both beasts of burden, so the conscientious "animal engineer" may safely treat either of these without sacrificing his prestige as a veterinarian.

The above sentences cover seven species of the animal kingdom that have at times honorably performed the functions of "beasts of burden." The personal belief of the writer is that any animal

is a tentative beast of burden, if man, with his greater intellect, so wills.

If we use the above as a standard, and it is all true, about the only ones of our colleagues who can not conscientiously refer to themselves as veterinarians are the hog specialists, the cat specialists and the sanitarians. These last three groups are veterinarians in the true sense, for their course in college taught them to treat sick and ailing beasts of burden, and while they may not be actually "working at it," in the broader sense they still remain veterinarians, and have the potential right and ability to treat said animals. The late Doctor Oliver Wendell Holmes, though a physician by profession, became a poet also but the fact that he was a poet did not detract one iota from his ability as a physician and an anatomist.

The Editor's suggestion is to broaden the definition of the word veterinarian to include the entire animal kingdom. As he stated in his able editorial, other words have been thus treated. A shining example of what modern interpretations of words can do is in the verb "manufacture." This, as we know, is derived from the words, *manus*, the hand, and *facio*, I make, or, literally, to make by hand. Yet, today the word "manufacture" means machine-made, and to take the place of what that word was originally intended to signify, modern language has coined the expression "hand-made." One could cite dozens of words interpreted differently now than originally.

For those few individuals among us upon whose sensitive nerves the title of veterinarian grates, there is always the title "veterinary physician and surgeon" to assume, and they will not be liable for any serious violation of professional ethics. This, they may supplement, if they so desire, with the statement, in small type, "Practice limited to dogs, cats, poultry, pigs, or what have you?"

No doubt there will be more discussions from members of the profession older and wiser than the writer, but if one so young may venture to express his humble opinion, he is satisfied to remain an ordinary veterinarian. This opinion apparently was shared by Liautard, Coates, Gill, McKillip, Salmon, Huidekoper, Hoskins, Sr., Adams, and other famous "zoophysicians," "doctors of animal industry,"—or call them what you will—who made veterinary history in this country when it was being pioneered.

M. J. HUGHES.

Newark, N. J., December 8, 1927.

ORGANIZATION OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION
1927-1928

OFFICERS

Reuben Hilty, President, 624 Huron St., Toledo, Ohio.
B. T. Simms, 1st Vice-Pres., Oregon Agricultural College, Corvallis, Ore.
Col. W. Geo. Turner, 2nd Vice-Pres., Office of the Surgeon General, Washington, D. C.
R. P. Marsteller, 3rd Vice-Pres., College Station, Texas.
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HORSE DUE TO STAGE COMEBACK

Old Dobbin, who only a few years ago had copious tears shed over his fate of being relegated to the zoos as a result of the inroads of the motor vehicle, now bids fair to stage a comeback in Dallas.

Police Commissioner Clarence Parker has taken the lead in urging that the mounted police be reinforced in Dallas for the purpose of controlling traffic. He is making a fight in the City Commission budget meetings for sufficient money to buy and equip twelve mounts for use in the downtown district. He contends that in congested traffic the mounted officer can control motor and pedestrian traffic better than an unmounted officer or one on a motorcycle.

—*The Horseshoers' and Blacksmiths' Journal.*

STATE BOARD EXAMINATIONS

Florida State Board of Veterinary Examiners. Gainesville, Fla. Jan. 9-10, 1928. Dr. A. L. Shealy, Secretary, University of Florida, Gainesville, Fla.

Iowa Veterinary Medical Examining Board. Des Moines, Iowa. Jan. 16-17, 1928. Dr. Peter Malcoln, Secretary, State House, Des Moines, Iowa.

Arkansas Veterinary Examining Board. Old State House, Little Rock, Ark. Feb. 19, 1928. Dr. Joe H. Bux, Secretary, Old State House, Little Rock, Ark.

ASSOCIATION MEETINGS

EASTERN IOWA VETERINARY ASSOCIATION

Over 300 persons were attracted to the fourteenth annual meeting of the Eastern Iowa Veterinary Association, held in Cedar Rapids, October 5-6, 1927. The heavy downpour of rain and the almost impassable condition of the roads would have seemed to indicate a small attendance, but by noon of the first day the hotel and the Local Arrangements Committee found their accommodations none too commodious. The harmony, the spirit of good-fellowship and cooperation that pervaded the entire convention and atmosphere was in sharp contrast to the reception accorded the conventioners by the weather man.

The technical program had many valuable contributions by eminent authorities. Dr. J. F. DeVine handled sterility subjects to the very great satisfaction of his hearers. Dr. A. T. Kinsley reviewed post-vaccination losses. Dr. C. H. Covault and Dr. E. L. Quitman gave attention to small animal practice and Professor L. H. Pammel, eminent authority on botany, gave an arresting lecture on poisonous plants. Dr. L. A. Merillat handled the question-box on general practice and reviewed the recent developments in the study of periodic ophthalmia.

Several practitioners prepared papers but were not heard, because of lack of time. These were Dr. F. E. Rugger, of Lowden, and Dr. John Patterson, of Hedrick, on poultry subjects; Dr. C. H. Banks, of Tipton, and Dr. R. M. Hofferd, of Fairfax, who had case reports. Dr. E. A. Buxton, of Vinton, reviewed vulvo-vaginitis of gilts and presented photos of aggravated cases. Early cases yielded to antiseptic, astringent and hygienic treatment. Dr. S. H. McNutt, Department of Veterinary Investigation, Iowa State College, reported that investigational work seemed to indicate that molds on corn were capable of producing the ailment.

Dr. J. H. Spence, of Clinton, opened the subject of tuberculosis eradication with a discussion of "The Practitioner and the Modified Area." Dr. J. A. Barger, B. A. I. Inspector, and Dr. Peter Malcolm, State Veterinarian, were heard in this connection. Dr. N. W. Ackerman, of Van Horne, discussed milk fever and the glucose treatment and Dr. John Patterson, of Hedrick,

added comments. It was the sentiment that the Schmidt treatment was still to be relied upon as the treatment of choice. Legislative activities were discussed by Dr. Raymond Johnston, of Richland, in an impromptu interview. Dr. Johnston is a member of the State Legislature. Dr. Frank Breed, of the Norden Laboratories, Lincoln, Nebraska, very instructively reviewed legislative matters as encountered by the Nebraska veterinarians.

Dr. Kinsley held that post-vaccination losses are very rarely due to faulty serum or virus. These losses are almost invariably referable to unhealthiness of hogs when vaccinated; to improper care and feeding of the recently vaccinated pigs; to diseases other than cholera, of which there is a great variety. Closer observation of the herd about to be vaccinated is the veterinarian's protection against post-vaccination losses. Dr. L. A. Merillat said that periodic ophthalmia is a disease of the horse characterized by a local ailment of the eye. It is encouraging that intensive work is being done on the etiology. Under present conditions Dr. Merillat advised that practitioners had best use as treatment the neoarsphenamine injection, together with local applications of atropin ointment.

Professor Pammel collected and labeled ninety different specimens of fresh plants that have toxic principles and are found in this section of Iowa. This afforded practitioners a rare opportunity to examine these plants in their fresh state. Plants vary in toxicity at various stages of their growth and animals vary greatly in their susceptibility to the effect of plant toxins. Dr. Pammel's lecture and its impressive presentation was warmly received by the convention. Dr. Covault and Dr. Quitman agreed that frights disease of dogs is a condition arising from many causes. In most cases these causes can be determined and rational treatment consists of their removal, after which recovery is prompt.

The first essential in sterility work is the ability to diagnose pregnancy. This involves a knowledge of the parts and a highly developed sense of touch. Massage of the genitals, the use of bacterins and strict attention to the general condition and the feeding of the patient were high points touched upon by Dr. DeVine in his lecture. Dr. DeVine demonstrated with what nicety the genitals may be manipulated. Two subjects were presented for diagnosis. One of these was affected with a pyometra and by inverting the uterus, through rectal manipu-

lation, with the hand in the vagina, the uterus was readily emptied of a quantity of pus. Dr. DeVine urged that efficiency in sterility practice is the result of painstaking application. He urged that breeding troubles are increasing with the increase in the dairy business and that it behooves practitioners to gain knowledge with which to combat these breeding ills.

The technical sessions were full of interest and took on much of the form of round-table discussions. The question-box covered a wide variety of questions and was handled by Dr. DeVine, on cattle problems; Dr. Kinsley, on hog subjects; and Dr. Merillat dealt with the questions on the horse and general practice. Small-animal queries and those on materia medica and therapeutics were referred to Dr. Quitman.

Sociability and good-fellowship were fostered through the banquet, entertainment and ball, and the ladies' entertainment program. These features have become very popular at these meetings. The banquet entertainment consisted of high-class musical numbers, toasts by distinguished guests and a black-face act by Cedar Rapids friends of the profession. The ladies' entertainment was provided complimentary to the ladies of the convention by certain commercial houses. The three high points on the program were a luncheon and an entertainment in the ball room of the Hotel Roosevelt, a style show especially arranged for the occasion by the Killian Store, and the gift to the lucky lady of a $35.00 floor lamp. Mrs. J. A. Barger won the lamp.

The officers for 1928 are: Dr. A. R. Menary, president; Dr. F. J. Crow, vice-president; Dr. John B. Bryant, secretary-treasurer; trustees, Drs. F. M. Wilson, H. A. McIntire and I. W. Moranville.

Upon the urgent invitation of practitioners Dr. DeVine was prevailed upon to postpone his return to New York until October 10, in order that sterility clinics might be held at Traer and Iowa City. Dr. R. C. Byrnes, of Traer, arranged the clinics at that place which were well attended by practitioners. The clinics at Iowa City were held at Dr. J. S. Potter's hospital and at the Oakdale Sanitarium. Seven cows were presented. One cow had been barren for two years. She was carrying a macerated fetus which was flushed out. This cow was then found hopeless, because of visceral adhesions, and was therefore consigned to the butcher. The second was diagnosed as a non-breeder due to fallopian tube involvement and ovaian trouble. The diagnosis

was confirmed when Dr. C. Bradley, of Marion, spayed the cow and removed the tubes with the ovaries. Of the remaining cows, four were found suffering from mineral unbalance and one that was reported sterile was found to be carrying a five-weeks fetus. Twenty-three practitioners attended this meeting, several having driven sixty miles and one veterinarian came eighty miles.

John B. BRYANT, *Secretary.*

SOUTHWEST IOWA VETERINARY ASSOCIATION

The Southwest Iowa Veterinary Association met at the Hotel Iowana, Creston, Iowa, October 26, 1927. An address of welcome was delivered by Mayor G. E. Newcomb, and the response was given by Dr. J. E. Ingmand, of Red Oak.

Dr. J. A. Barger, of the Bureau of Animal Industry, gave a very interesting and instructive talk on "Tuberculosis in Cattle and Its Eradication in Iowa." Dr. A. H. Quin, Jr., gave a talk on diseases of swine and dwelt on diseased conditions that arise after vaccination. Dr. Minick gave a lecture on contagious abortion and its control in cattle.

The lecture on the diseases of poultry and their treatment, by Dr. Charles Murray, of Iowa State College, was very instructive and well received.

The election of officers for the ensuing year resulted as follows: Dr. T. E. Anderson, of Bedford, president; Dr. T. D. Weimer, of Cumberland, vice-president; Dr. R. D. Abarr, of Blackton, secretary-treasurer.

A banquet was served at 7:00 p. m. for the visiting veterinarians and their wives by the Corn States, United, Fort Dodge and Royal Serum companies.

A ladies' auxiliary was organized, with Mrs. C. P. Liegerot, of Red Oak, president; Mrs. A. J. Abarr, of Clearfield, vice-president; and Mrs. D. L. Schantol, of Orient, secretary-treasurer.

THOS. E. ANDERSON, *President.*

VETERINARY MEDICAL ASSOCIATION OF NEW YORK CITY

The regular monthly meeting of the Veterinary Medical Association of New York City was held at the Academy of Medicine, 2 E. 103rd St., New York City, November 2, 1927. President

C. G. Rohrer presided. Attendance—23. The minutes of the October meeting were read and approved.

The speaker for the evening was Dr. C. V. Noback, of the New York Zoological Park, New York City. His topic was "Ultra-Violet Irradiation of Primates with a Form of Cage Paralysis (Rickets)." Dr. Noback's paper was exceptionally interesting, since heliotherapy is a very new field and one which points fair to being a great aid to the city veterinarian who has to treat his cases in the absence of a full amount of Nature's sunlight. Dr. Noback's paper was not written on predictions, but he had the data of actual application in the Zoological Garden and the men in the human field with whom he had the opportunity to work. The paper was quite thoroughly discussed by Drs. Chas. Higgins, E. A. Durner, O. E. McKim and Jacob Lebish, showing the interest of the veterinarians.

It was regularly moved, seconded and carried that a rising vote of thanks be extended Dr. Noback. As there were no other papers for the meeting, the report of the Publicity and Policy Committee of the New York State Veterinary Medical Society was read and discussed. No final action was taken, but it was moved, seconded and carried that it be laid on the table until the December meeting.

Dr. E. R. Cushing showed a very interesting case of a fistula of the ear in a thirteen-year-old Boston terrier dog.

Dr. R. S. MacKellar reported that Dr. W. J. Magee, 790 Mott Ave., New York City, died of a paralytic stroke, November 1, 1927, at the age of 71. Dr. Magee was until late years an active member of this Association.

There being no further business, it was moved, seconded and carried that the meeting adjourn.

C. P. Zepp, *Secretary.*

HUDSON VALLY VETERINARY MEDICAL SOCIETY

The regular quarterly meeting of the Hudson Valley Veterinary Medical Society was held at Poughkeepsie, N. Y., November 15, 1927, with Dr. Wright J. Smith, President, in the chair.

This meeting was attended by about twenty-five members of the profession, nearly all contributing some interesting case report or joining in the discussion.

Attention was called to an article in the New York *Times* of Sunday, November 13, relative to training, at the Army Veter-

inary School at Washington, of men for veterinary work. According to this article, approximately five months of instruction is given "which not only qualifies the students successfully completing the course for higher ratings in the service, but for good paying positions in civil life upon discharge." The opinion was expressed in the course of the discussion on this subject, that this plan, if true, would result in lowering the standing of the profession in the military service and result in improperly trained men replacing the graduate veterinarian. The Secretary was asked to obtain further details and report.

Considerable discussion in relation to the control of rabies resulted in the general conclusion that this was a function that could be better exercised by veterinarians than by health officers, as is the present plan in this state.

The election of officers resulted in the selection of Dr. John McCartney, Middletown, president; Dr. Wm. Henry Kelly, Albany, vice-president; Dr. J. G. Wills, Albany, secretary-treasurer.

J. G. WILLS, *Secretary.*

ONEIDA-HERKIMER COUNTY VETERINARY MEDICAL ASSOCIATION

On Wednesday evening, November 16, 1927, the veterinarians of Oneida and Herkimer counties, New York, met at the Elks Club, Utica, N. Y., at the call of Dr. W. G. Hollingworth, City Veterinarian.

At this meeting the Oneida-Herkimer County Veterinary Medical Association was organized. This association was formed with the following purposes in view: To protect the public health of this country. To protect the live stock owner and animal industry of this country. To help eradicate diseases transmissible from animal to man. To establish a better feeling of loyalty among the members of the profession and to form a medium through which they might meet and know one another better.

The following officers were elected: President, Dr. W. G. Hollingworth, Utica; vice-president, Dr. L. G. Moore, Barneveld; treasurer, Dr. Arthur A. Brockett, Little Falls; secretary, Dr. Don A. Boardman, Rome.

The number of times the Association will meet will be determined at the next meeting.

DON A. BOARDMAN, *Secretary.*

HORSE ASSOCIATION OF AMERICA

Some new plans for the future of the Horse Association of America were made at the eighth annual meeting of the Association, held at the Palmer House, Chicago, on November 30, 1927. These involve, roughly:

1. A reorganization of the financial structure which will treble the working funds of the Association.
2. Expansion of the direct city service, so that any transportation user can obtain personal help in analyzing routes, delivery costs, and ratio of costs to sales.
3. Increase in field work, to help more farmers to use the big-team hitches. Experience has shown that farmers can not make up the hitches and apply the "tying-in" and "bucking-back" system without seeing an actual demonstration in the field, but that they can and do apply the methods readily after seeing one demonstration.
4. Paid advertising on a national scale to put before farmers and the general public the foregoing points (2 and 3) and to emphasize that horses and mules are the most reliable, flexible and dependable power in cities or on farms, when used in their proper field and in right-sized units.

The year's work was reviewed by W. S. Dunham, of Wayne, Illinois, president, and Wayne Dinsmore, of Chicago, secretary, of the Horse Association of America. Three principal lines of endeavor were stressed—the big-hitch demonstrations, work to increase use of horses in cities, and pulling contests. Of the first there have been 356, given in 13 states and one Canadian province, since December, 1926. These have been attended by some 66,000 farmers.

The hitch demonstrations teach farmers, by using their teams in large units, to accomplish large amounts of work per day and reduce production costs. States that had hitch demonstrations this year are: Indiana, Michigan, Illinois, Wisconsin, Missouri, Iowa, Minnesota, Kansas, Nebraska, South Dakota, Wyoming, New York and Colorado. Many 8-, 10- and 12-horse teams have gone into use on plows, discs and harrows as a result of them.

Two men are engaged in city survey work for the Horse Association of America—one in New York and one in Chicago. They cooperate with transportation users in installing accurate cost-accounting systems and arriving at exact figures as to what each type of delivery equipment is costing. Thus, it is possible to keep the right kind of equipment operating in the right place.

The broadened plans of the Association look to placing a representative in each of the leading cities of the United States, since the value of the survey work has been so well realized and companies are showing readiness to cooperate in cutting delivery costs.

Officers and directors of the Horse Association of America were elected as follows: To succeed themselves—W. S. Dunham, of Wayne, Ill., president; R. Lawrence Smith, of New York, N. Y., first vice-president; William M. Brezette, of Catasauqua, Pa., treasurer; Wayne Dinsmore, of Chicago, Ill., secretary; and William E. Murphy, of Philadelphia, Pa., assistant secretary. L. J. Elliott, of Racine, Wis., was elected second vice-president.

W. D.

KANSAS CITY ASSOCIATION OF VETERINARIANS

The regular monthly meeting of the Kansas City Association of Veterinarians was held at the hospital of Dr. H. M. McConnell, Independence, Mo., Wednesday evening, December 14, 1927. Twenty-seven veterinarians were present. Mrs. McConnell entertained the ladies at a theatre party. The program for the evening pertained to udder troubles of dairy cattle.

Mr. O. C. Murphy, director of the Food and Dairy Division of the Kansas City Board of Health, talked on "The Effects of Physical Examination of Dairy Cows on the Milk Supply of Kansas City." Dr. Ashe Lockhart discussed "The Pathology and Bacteriology of Mammitis." Dr. H. M. McConnell discussed "Mammitis in General Practice." Dr. J. L. Wells, of Blue Springs, Mo., and Dr. C. A. Schulz, of Independence, gave interesting case reports. Dr. R. C. Moore, of St. Joseph, Mo., discussed "Mammitis in General." A very interesting and instructive discussion followed each speaker.

The following were elected officers for 1928: Dr. J. L. Wells, Blue Springs, Mo., president; Dr. E. L. Young, Grandview, Mo., vice-president; Dr. J. D. Ray, Kansas City, Mo., secretary-treasurer.

The retiring President, Dr. S. L. Stewart, of Olathe, Kans., has had a most successful year in office. The above program is typical of those furnished during 1927.

J. D. Ray, *Secretary.*

NORTHERN TIER VETERINARY CLUB

The annual meeting of the Northern Tier (Pennsylvania) Veterinary Club was held November 15, 1927. Dr. Wiley W. Congdon, of Athens, was elected president and Dr. Walter P. Lynch, of Towanda, secretary.

NECROLOGY

JOHN ANDREW KIERNAN

Dr. John A. Kiernan, Chief of the Tuberculosis Eradication Division of the U. S. Bureau of Animal Industry, died at his home in Washington, D. C., December 13, 1927. He had been ill for several weeks, following an intestinal disturbance, and was believed to be making satisfactory progress toward recovery. Heart complications were responsible for his sudden death.

Born in Jersey City, N. J., July 27, 1873, Dr. Kiernan received his veterinary education at the New York College of Veterinary Surgeons. He was graduated with the class of 1894. After engaging in general practice for two years he entered the service of the Bureau of Animal Industry.

Upon his entry into the government service, Dr. Kiernan was assigned to meat inspection, in Boston. He took an active part in the 1902 outbreak of foot-and-mouth disease in New England, and following its suppression was transferred to field work in the West, with headquarters at Salt Lake City. Cattle scabies was the next problem to receive Dr. Kiernan's attention and for three years he was stationed at Aberdeen, S. Dak., in the fight against this parasite.

As a result of his demonstrated ability in handling difficult problems, Dr. Kiernan was one of the first men to be placed in charge of a station for the eradication of cattle ticks in the South. His first assignment as inspector-in-charge was at Raleigh, N. C., from which point he directed tick-eradication work in North Carolina and Virginia. Later he was transferred to Nashville, where he directed the work in progress in Tennessee, Alabama and Mississippi.

In 1917 the Tuberculosis Eradication Division of the Bureau was created for the purpose of carrying on tuberculosis eradication in a systematic manner, in cooperation with the various states. Again Dr. Kiernan's demonstrated ability qualified him for an important assignment and he was selected as chief of the newly created division. From a small beginning, the project of eradicatng bovine tuberculosis from the herds of this country has grown into one of the most important activities of the Bureau of Animal Industry. It would be difficult to estimate how much of this wonderful progress has been the result of Dr. Kiernan's

sterling ability and dynamic leadership. In commenting upon Dr. Kiernan's accomplishments, Dr. John R. Mohler, Chief of the Bureau of Animal Industry, paid his departed colleague this tribute: "Although standing out, during his entire career, as a leader, Dr. Kiernan was always generous in dealing with others. He encouraged subordinates to take responsibility and assume leadership." Dr. Mohler characterized Dr. Kiernan as "a capable executive, a veterinarian of high professional attainments, and a man whose personality and leadership inspired the best efforts of those under his direction and associated with him."

Dr. Kiernan joined the A. V. M. A. in 1908 and was a familiar figure at many of the conventions. For five years (1919-24) he represented District No. 4 on the Executive Board. Prior to that term of office Dr. Kiernan was a member of the Committee on Intelligence and Education (1917-19). He was a member (1925-26) and chairman (1924-25) of the Committee on Tuberculosis and chairman of the Committee on Legislation (1925-26). Dr. Kiernan was equally active in the work of the United States Live Stock Sanitary Association.

Dr. Kiernan is survived by his widow and three sons.

JAMES AUSTIN LOGAN

Dr. James A. Logan died at Colorado Springs, Colo., November 19, 1927. Born in Bismarck, N. Dak., September 14, 1887, Dr. Logan attended the local grade and high schools. He then entered the Chicago Veterinary College and received his degree in 1910. Dr. Logan located for general practice in Oakes, N. Dak., in 1912 and remained there until 1919, when his health failed and he was obliged to go to Colorado. During the long period of his illness in a Colorado Springs hospital, his cheerful disposition earned him the sobriquet, "Pollyanna of the Third Floor."

Dr. Logan joined the A. V. M. A. in 1912. He was married to Miss Adelaide Hanley, of Milwaukee, in 1915. She died during the flu epidemic of 1918. Dr. Logan is survived by his mother, three sisters and two brothers.

A. M. SEVEY

Dr. A. M. Sevey died at Huntington Park, Calif., July 8, 1927. He was a graduate of Kansas City Veterinary College, class of 1915, and practiced in Illinois and Missouri before going to California.

NELSON V. BOYCE

Dr. N. V. Boyce, of Kansas City, Kans., died November 10, 1927. He was born at Fair Haven, Ohio, October 29, 1857, and was a graduate of the Kansas City Veterinary College, class of 1899. Dr. Boyce had been in the service of the Bureau of Animal Industry since June 1, 1900. He joined the A. V. M. A. in 1918.

EDWIN S. FRY

Dr. Edwin S. Fry, of Naperville, Ill., died at his home, November 16, 1927, after an illness of but a few days. Born in Lancaster County, Pennsylvania, July 20, 1851, the deceased located in Naperville in 1873. He entered the Chicago Veterinary College and was graduated in 1894. Dr. Fry practiced in Naperville and vicinity for over twenty years and retired a few years ago. He is survived by his widow, one son and two daughters.

DALE PUGH

Dr. Dale Pugh, of Sabina, Ohio, died at his home, November 22, 1927. He was a graduate of Ohio State University, class of 1917, and had practiced at Sabina since graduation. Dr. Pugh is survived by his widow, one daughter, three sons and two sisters.

SCHUYLER M. WELLS

Dr. Schuyler M. Wells, of Linton, Indiana, died at his home, November 25, 1927. He was born at Freelandsville, Indiana, March 31, 1874, and was a graduate of the Indiana Veterinary College, class of 1902. The cause of his death was cancer of the jaw bone, from which he had been suffering for about a year. Dr. Wells is survived by his widow, one daughter, three sons, and several brothers and sisters.

WILLIAM J. HOWDEN

Dr. William J. Howden, of Flint, Mich., died at his home, December 11, 1927, after an illness of about a year. Born in Peterborough, Ontario, May 29, 1869, he located in Flint in 1895. He later entered the Ontario Veterinary College and was graduated in 1911. He was a member of the Michigan State Veterinary Medical Association. Surviving him are his widow, one son and one daughter.

Our sympathy goes out to Dr. J. H. Caldwell, of Calgary, Alberta, in the death of his wife, November 14, 1927, and to Dr. George W. Todd, of Lancaster, Calif., in the death of his father recently.

Dr. Albert M. Hart, of Brownstown, Ill., died December 11, 1927, after a short illness. He was in his 88th year. Dr. Hart was a Civil War veteran and at one time was an assistant state veterinarian.

Dr. William J. Magee, of New York, N. Y., died November 1, 1927, following a paralytic stroke.

MARRIAGES

Dr. Benjamin Kater McInnes (U. P. '11), to Miss Mary McIver Wilbur, both of Charleston, S. C., November 19, 1927, at Charleston, S. C.

Dr. G. A. Ferguson (U. S. C. V. S. '20), of Leaksville, N. C., to Miss Sara Hunt, of Greensboro, N. C., at Greensboro, N. C.

PERSONALS

Dr. L. F. Maier (O. S. U. '15) is now stationed at Caro, Mich.

Dr. Edw. A. Wilson (U. P. '23) has removed from Hackettstown, N. J., to Emaus, Pa.

Dr. Edgar D. Wright (Ont. '13), formerly of Monticello, Ind., is now located at Flora, Ind.

Dr. Frank A. Bonnstetter (Iowa '24) has removed from Belmond, Iowa, to Algona, Iowa.

Dr. J. C. Wickham (O. S. U. '12), formerly of Galena, Ohio, is now located at Wooster, Ohio.

Dr. Clifford Latimer (Ont. '24), formerly of Boissevain, Man., is now located in Winnipeg, Man.

Dr. Fraser A. Smith (Ont. '00) has retired from the firm of Hagyard and Smith, of Lexington, Ky.

Dr. Roswell P. Balentine (U. P. '19), of Mifflintown, Pa., has been elected treasurer of Juniata County (Pa.)

Dr. A. A. Moore (Gr. Rap. '12), of Edwardsville, Ill., has a new small-animal hospital under construction.

Dr. R. E. Bergman (Mich. '21), of Cassopolis, Mich., has been appointed Live Stock Agent for Cass County, Mich.

Dr. C. H. Reading (Mich. '27), of Hopkins, Mich., has been appointed Allegan County (Mich.) Live Stock Agent.

Dr. A. E. Rowson (Ont. '18), formerly of Drumheller, Alta., has opened a small-animal hospital at 1004 East 6th St., Duluth, Minn.

Dr. J. J. Frey (K. S. A. C. '16) has requested a change of address from Sacramento, Calif., to 962 Cragmont Ave., Berkeley, Calif.

Dr. A. L. Tiffany (Ont. '05), of Monroe, Mich., has been appointed Fleet Surgeon of the Monroe Yacht Club. Not bad for a veterinarian.

Capt. Rafael F. Santa Maria (Havana '10), who has been in Washington, D. C., the past year, is now located at Zambrana, Camaguey, Cuba.

Dr. William K. Nugent (Corn. '25), of Philadelphia, Pa., was the victim of an atack of diphtheria recently. At latest reports he was convalescing.

Dr. L. E. Stanton (Iowa '25) has returned to Owatonna, Minn., for general practice. Dr. Stanton left Owatonna some time ago to locate at Burt, Iowa.

Dr. H. H. Sparhawk (O. S. U. '08) is back in Detroit, Mich., after having spent about a year at Howell, Mich. His Detroit address is 5390 Bangor Ave.

Dr. G. S. Glover (U. S. C. V. S. '16), formerly with the California State Department of Agriculture, is now with the Ideal Certified Dairy, Glendale, Calif.

Dr. L. L. Glynn (N. Y.-Amer. '08), of Monte Vista, Colo., has purchased the practice of Dr. Geo. W. Dickey (Ont. '86), 319 N. Weber St., Colorado Springs, Colo.

Dr. R. G. Flowers (Ont. '06), of Fort Worth, Texas, was recently elected president of the Dallas-Fort Worth Veterinary Medical Association for the ensuing year.

Dr. Fred G. Harbaugh (Iowa '27), of Wilmette, Ill., has accepted a position in the Department of Animal Husbandry in the Texas Technical College, at Lubbock, Texas.

Dr. L. W. Lowery (McK. '18), of Glasford, Ill., has accepted a position in the Illinois State Department of Agriculture and has reported for duty at the Union Stock Yards, Chicago.

Dr. H. T. Clarno (Chi. '18) of Farmer City, Ill., has been appointed Piatt County Veterinarian by the Board of Supervisors. Dr. Clarno has given up his private practice at Farmer City.

Dr. W. R. Van Ness (Ont. '07-McK. '08), who has been in the employ of the U. S. Bureau of Animal Industry for the past twelve years, has located at Lebanon, Ohio, for general practice.

Dr. F. H. Barr (Chi. '92), of Albuquerque, N. Mex., was confined to his bed with an attack of influenza during November. He was able to resume his practice the early part of December.

Dr. C. G. Kreidler (Cin.'13), who has been Deputy State Veterinarian of Kentucky for several years, has resigned this position and has located at Maysville, Ky., for general practice.

Dr. A. J. Sipos (Geo. Wash. '16) has accepted a new position in Virginia. Dr. Sipos was formerly located in Newark, N. J., and now receives his mail at 103 State Office Bldg., Richmond, Va.

Dr. F. P. Wilcox (Geo. Wash. '16), Director, Division of Dairy Products, Los Angeles County, California, has a new address: c/o County Health Department, Hall of Justice, Los Angeles.

Dr. R. P. Gingerich (Chi. '13), Market Milk Specialist, Bureau of Dairy Control, California Department of Agriculture, is now located at Room 301, 784 South Central Ave., Los Angeles, Calif.

Dr. W. B. Whyte (Ont. '24), for a number of years associated with Dr. H. T. Carpenter (Ont. '88), of Detroit, Mich., has purchased the practice of the late Dr. O. C. Spencer, of Highland Park, Mich.

Dr. S. J. Horne (K. C. V. C. '14),who has been stationed at Jacksonville, Fla., in charge of tick eradication for the B. A. I., has resigned to accept a position with a live stock company in southern Florida.

Dr. W. Calvin Nickel (U. P. '16), of Nazareth, Pa., was elected to the office of coroner of Northampton County on all three tickets—Republican, Democratic and Prohibition—at the recent Pennsylvania elections.

Dr. I. B. Boughton (O. S. U. '16) spent a three-months vacation in France, following the Philadelphia meeting of the A. V. M. A. Dr. Boughton returned to his post of duty, Port au Prince, Haiti, about December 1.

Dr. Albert R. Potteiger (Ont. '91), of Selingsrove, Pa., has been elected treasurer of Snyder County (Pa.). It is reported that Dr. Potteiger polled the highest vote of any candidate for office at the fall elections.

Dr. L. C. Stewart (K. C. V. C. '18) has resigned from the U. S. Bureau of Animal Industry and has gone into practice at East St. Louis, Ill. Dr. Stewart has established the St. Clair Pet Clinic at 42nd & State Streets.

Dr. H. Glenn Ricker (U. P. '20) has given up his private practice at Millheim, Pa., to accept a position with the Supplee-Wills-Jones Company, of Philadelphia. Dr. Ricker has his headquarters at Chambersburg, Pa.

Dr. J. M. Atterberry (Chi. '13), of Albion, Ill., has received an appointment in the Illinois State Department of Agriculture. Dr. Atterberry will retain his residence in Albion, although his work will take him out over the State.

Dr. G. Leroy Cheney (Ont. '08) and Dr. James J. Flaherty (U. P. '12), of New Haven, Conn., have formed a partnership, which will be conducted under the name of Cheney & Flaherty, with office and hospital at 40 Whiting Street.

Dr. R. O. Mudd, of Lewiston, Ill., has been appointed Morgan County (Ill.) Veterinarian by the County Board of Commissioners, succeeding Dr. Thomas K. Jones (Chi.'18), who has gone to Iowa. Dr. Mudd took up his duties December 1.

Dr. Harry Morin (Chi. '10), of Clinton, Ill., had a miraculous escape from death, when his automobile was struck by an interurban car and completely demolished, the latter part of November. The accident happened just south of Clinton.

Dr. M. Shipley (T. H. '17), of Phoenix, Ariz., won two grand championships, three champions, six first, three seconds and one third prize with his pure-bred Hampshire hogs at the Arizona State Fair, held at Phoenix, November 7-12, 1927.

Dr. Cassius Way (Corn. '07), of New York City, received some rather painful injuries while working with a yearling colt in Virginia, in November. According to a recent report he was making a satisfactory recovery from his injuries, but was compelled to wear a heavy corset to hold the right sacroiliac articulation in proper place during the repair process.